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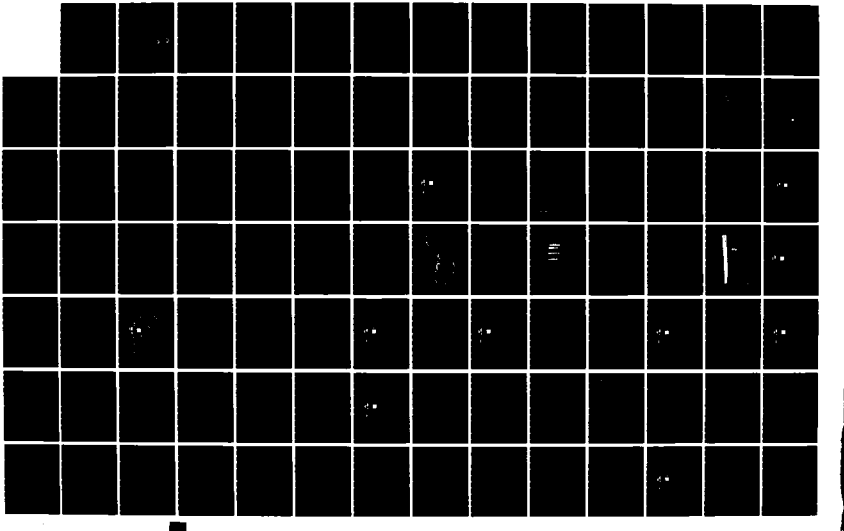

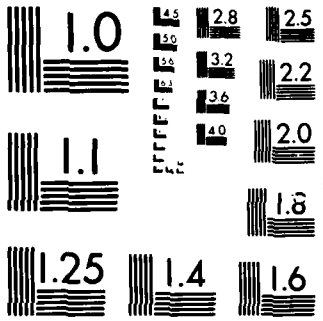

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Installation Restoration Program
Phase I — Records Search

Air Force Plant 44
Tucson, Arizona

Prepared for:
United States Air Force
AFESC/DEV
Tyndall AFB, Florida
and
Air Force Systems Command/Aeronautical Systems Division
Wright-Patterson AFB, Ohio

Prepared by:
Science Applications International Corporation
8400 Westpark Drive
McLean, Virginia 22102

October 1985

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This report provides an introduction, description, and environmental setting of Air Force Plant 44, Tucson Arizona. It review past and present practices of wastewater treatment, landfills, waste oil pits, chrome and die yard pits, disposal and spill sites. A total of 11 sites were ranked using the HARM (Hazard Assessment Rating Methodology) rating system.

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EXECUTIVE SUMMARY

This report presents the findings of the Installation Restoration Program (IRP) Phase I Records Search/Installation Assessment of Air Force Plant 44 (AFP 44) located near Tucson, Arizona. Previous comprehensive environmental hydrogeologic investigations have been conducted on and around AFP 44 to determine the nature of environmental contamination from past hazardous waste management practices in the Tucson International Airport (TIA) area. Objectives of this investigation included the review of these investigations and any additional historical information obtained from interviews and site records, and the preparation of a comprehensive Phase I report in the IRP format. As intended under Phase I of the Air Force IRP, this investigation also identified the potential for environmental contamination from past management of hazardous substances at AFP 44 and assessed the probability of contaminant migration that could have an adverse effect on public health or the environment.

Installation Description

AFP 44 is a government-owned, contractor-operated (GOCO) installation located approximately 15 miles south of downtown Tucson. The plant property occupies 2,258 acres, of which over 80 percent is undeveloped desert.

Hughes Aircraft Company operates AFP 44 under a facilities contract with the Air Force's Aeronautical Systems Division (ASD) at Wright-Patterson Air Force Base (AFB), Ohio. Current activities include the manufacture, development, and testing of missile systems under acquisition contracts with the Air Force, Army, and Navy. Historical activities have been similar.

A potential groundwater contamination problem in the TIA area was identified in 1981 by the U.S. EPA. Subsequent environmental investigations at AFP 44 were conducted in cooperation with the investigative efforts by the U.S. EPA and the State of Arizona and have confirmed that AFP 44 is one of a number of contributors to the groundwater problem in the TIA area. Numerous investigations performed at and in the vicinity of AFP 44 by Hughes Aircraft and the Air Force have determined the extent and magnitude of groundwater contamination at the facility. Based on the findings from these studies, a plan for contaminant

control and remedial action implementation (IRP Phase IV) has been published (October 1985) for public review and comment. This plan will be executed once it is finally approved.

Environmental Summary

The following summarizes the major environmental characteristics in the vicinity of AFP 44:

- The regional aquifer system that exists in the vicinity of AFP 44 is comprised of an upper and lower zone. These two zones are separated by a thick sequence of clayey sediments which acts as an aquitard and restricts the movement of water between the two aquifer zones.
- A sandy clay layer occurs above the regional water table in the vicinity of AFP 44. This layer also acts as an aquitard and retards the downward movement of fluids. This aquitard has caused the development of a perched groundwater zone beneath plant property in the vicinity of the former waste disposal areas. Contaminants from these former disposal areas have been found in the perched zone.
- The regional water table beneath AFP 44 occurs at depths from 100 to 140 feet below land surface.
- Regional groundwater flows in a northwest direction.
- The regional aquifer underlying the City of Tucson is a sole source aquifer in the Tucson area.
- Concentrations of the organic solvents trichloroethylene (TCE), 1,1,1-trichloroethane (TCA), and 1,1-dichloroethylene (DCE) occur in the regional aquifer beneath AFP 44.
- Concentrations of hexavalent chromium (0.2-0.5 ppm) occur in the regional aquifer beneath AFP 44 in two small, restricted areas.
- Five general contaminant source areas were tentatively delineated in the TIA area by the Arizona Department of Health Services and were believed to have contributed to the overall groundwater problem in the area. One of the source areas was identified as including former waste disposal sites at AFP 44.
- Four contaminant areas emanated in a northwesterly direction from the five general contaminant source areas.
- The area of contamination emanating from AFP 44 probably has migrated to the vicinity of Los Reales Road.

- Contamination in the regional aquifer emanating from the TIA area has resulted in the closing of seven City of Tucson water supply wells and two AFP 44 water supply wells. One of these city wells and both AFP 44 production wells were closed in response to the discovery of groundwater contamination at AFP 44.

- Surface water drainage is controlled by two intermittent streams, several drainage channels, and the plant's storm drain system. The ultimate discharge of surface water is into the Santa Cruz River.

- The soils within the plant area are generally well-drained and moderately permeable, originating from the alluvial sediments of the Tucson Basin.

- The AFP 44 area has an annual net precipitation rate of minus 55 inches, which provides a low driving force for contamination migration.

Findings and Conclusions

Review of past operations and waste management practices at AFP 44 has identified 11 sites that may have caused contamination and contaminant migration. The identified sites have been evaluated and ranked using the Air Force Hazard Assessment Rating Methodology (HARM). As noted above, extensive environmental investigations have already been performed and a remedial action plan has been developed which will be implemented once approved. In addition, response measures have already been implemented at some sites where, on the basis of prior investigations, such actions were considered necessary to prevent the continued release of contaminants.

The current environmental monitoring program at AFP 44 is considered to be sufficiently comprehensive to constitute an IRP Phase II program. Additionally, data acquired to date has allowed a determination of the extent and magnitude of contamination resulting from past waste management activities and the selection of Phase IV remedial action.

Recommendations

AFP 44 should:

- Expedite implementation of the remedial action plan

- Continue environmental monitoring at the facility to assess remedial action effectiveness and to ensure that sites identified by this Phase I are no longer sources of continued contaminant release

- Remove all underground tanks and perform any necessary remedial actions, e.g., the excavation of any contaminated soils in the vicinity of the underground tank sites

- Sample and analyze soils in the area of Site 13, a former waste oil spreading site, for the presence of PCBs. This should be done only as a precautionary measure, since the records search did not reveal any evidence that PCB-containing oils were disposed in this area.

- Seal any wells that are screened in both the upper and lower zones of the regional aquifer and in the path of an area of groundwater contamination.

1.0 INTRODUCTION

1.1 BACKGROUND AND AUTHORITY

Because of its primary mission, the United States Air Force (USAF) has long been engaged in a wide variety of operations dealing with toxic and hazardous materials. Federal, state, and local governments have developed strict regulations to require that disposers identify the locations and contents of disposal sites and take action to eliminate the hazards in an environmentally responsible manner. The primary Federal legislation governing disposal of hazardous wastes is the Resource Conservation and Recovery Act (RCRA) of 1976, as amended. Under Sections 3012 and 6003 of RCRA, Federal agencies are directed to assist the Environmental Protection Agency (EPA) and state agencies in the inventory of past disposal sites and to make the information available to requesting agencies. The Department of Defense (DOD) developed the Installation Restoration Program (IRP) to identify and eliminate in an environmentally responsible manner any hazards related to past disposal sites on Air Force facilities. The current DOD IRP policy is contained in Defense Environmental Quality Program Policy Memorandum (DEQPPM) 81-5, dated 11 December 1981 and implemented by Air Force (AF) message dated 21 January 1982. DEQPPM 81-5 reissued and amplified all previous directives and memoranda on the IRP. DOD IRP policy is to identify and fully evaluate suspected problems associated with past hazardous contamination and to control hazards to health and welfare that resulted from these past operations. The IRP is the basis for response actions on Air Force installations under the provisions of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, clarified by Executive Order 12316, and 40 CFR 300 (National Contingency Plan).

The Air Force IRP is a four-phase program, as shown by Figure 1-1. The four phases are as follows:

1. Phase I - Installation Assessment (Records Search). Phase I is the responsibility of the Air Force Engineering and Services Center (AFESC) and is intended to identify and prioritize those past

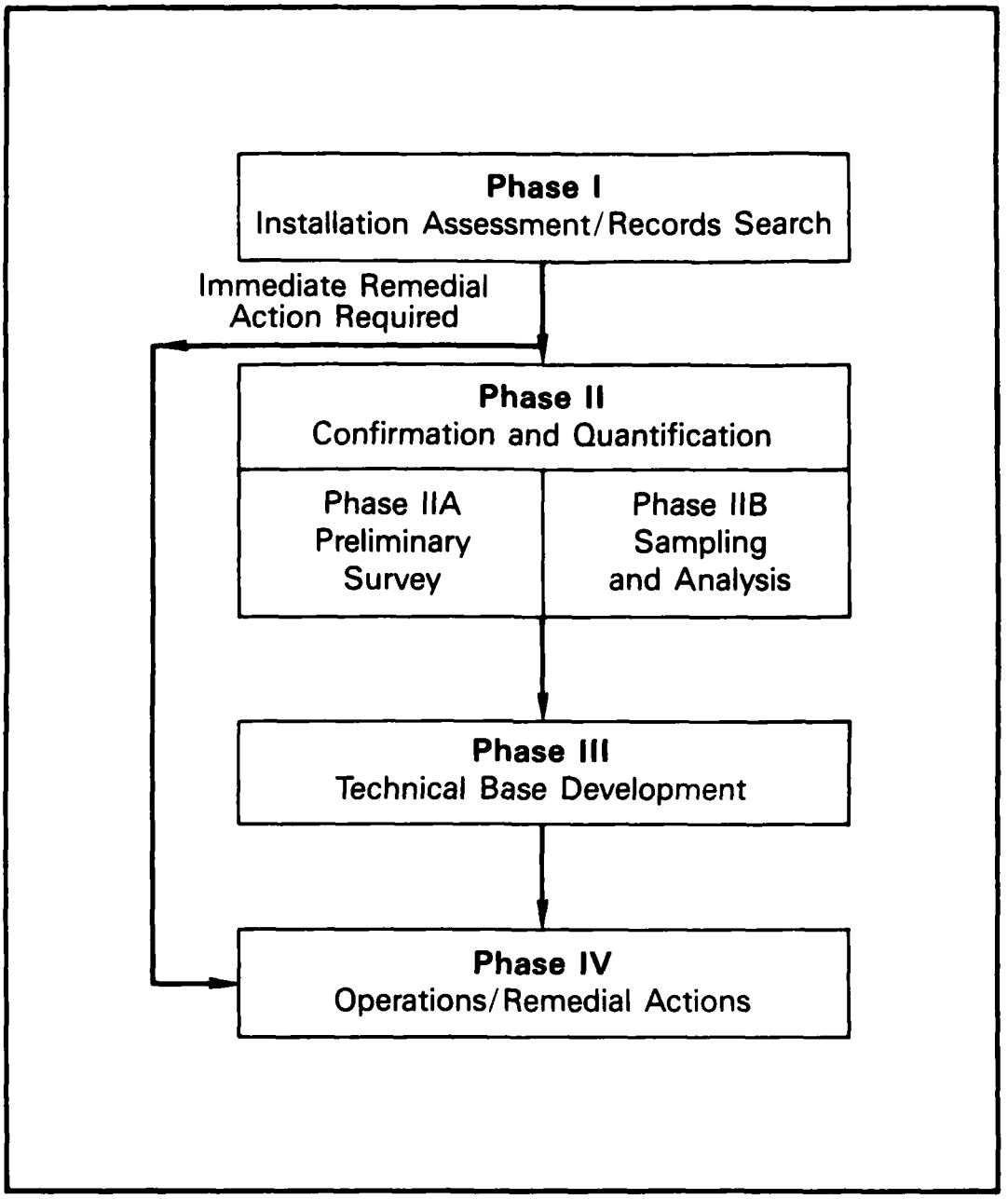


Figure 1-1. Phases of the Air Force Installation Restoration Program

disposal sites that may pose a hazard to public health or the environment as a result of contaminant migration to surface or groundwaters, or have an adverse effect by contaminant persistence in the environment. In this phase, it is determined whether a site requires further action to confirm an environmental hazard or whether it may be considered to present no hazard at this time. If a site requires immediate remedial action, such as removal of abandoned drums, the action can proceed directly to Phase IV. Phase I is a basic background document for the Phase II study.

2. Phase II - Confirmation/Quantification. Phase II is the responsibility of the Air Force Medical Service and is intended to define and quantify, by preliminary and comprehensive environmental and/or ecological survey, the presence or absence of contamination and the nature and extent of contamination; and identify sites or locations where remedial action is required in Phase IV. Research requirements identified during this phase will be directed to AFESC for inclusion in the Phase III effort of the program. Needs for contaminant health standards will be identified to the Command Surgeon for resolution.

3. Phase III - Technical Base Development. This phase is the responsibility of the Air Force Engineering and Services Center and is intended to develop a sound data base upon which to prepare a comprehensive remedial action plan. This phase includes implementation of research requirements and technology for objective assessment of adverse effects. A Phase III requirement can be identified at any time during the program.

4. Phase IV - Operations/Remedial Actions. This phase is the responsibility of the Air Force Engineering and Services Center and includes the preparation and implementation of the remedial action plan. In addition, the Air Force Medical Services has environmental monitoring responsibility during this phase.

1.2 PURPOSE

This investigation formally constitutes the Phase I IRP Records Search for Air Force Plant 44 (AFP 44) located near Tucson, Arizona. Comprehensive environmental and hydrogeologic investigations have already been conducted on and around AFP 44 to determine the nature of environmental contamination from past waste management practices in the Tucson International Airport (TIA) area. Investigations have been conducted in the TIA area by the USAF, the EPA, the Arizona Department of Health Services (ADHS), the Arizona Department of Water Resources (ADWR), and the City of Tucson. An extensive hydrogeologic investigation and monitoring program has been conducted by Hargis & Associates, Inc. (formerly Hargis & Montgomery, Inc.) at and in the vicinity

of AFP 44. These investigations have collectively identified potential areas and sources of environmental contamination in the area of AFP 44. The objectives of this Phase I investigation was to review the previous record searches and investigations conducted by the USAF, Hughes Aircraft Company (operator of AFP 44), Hargis and Associates, and the EPA; review any additional information from interviews and site records; and prepare a comprehensive Phase I report in the USAF IRP prescribed format. This report is also intended to provide sufficient information to aid and support the ongoing IRP efforts at AFP 44.

1.3 SCOPE

The scope of this Phase I investigation of AFP 44 includes all Air Force and Air Force contractor activities for currently and previously owned U.S. Government property. The report includes all activities by Hughes Aircraft Company (hereafter referred to as Hughes) located physically on AFP 44 property. Phase I activities included the following:

- Obtaining environmental data from Federal, state, and local offices
- Conducting an on-site visit including the following:
  - records review
  - personnel interviews
  - field investigation
- Reviewing retired records from Air Force System Command (AFSC), Wright-Patterson AFB, OH
- Reviewing reports compiled by Ecology and Environment, Inc. (Field Investigation Team Report of AFP 44) and Hargis & Montgomery, Inc. (now Hargis & Associates); including the review of hydrologic monitoring data and findings compiled by the latter
- Evaluating hazardous material management practices using the Air Force's Hazard Assessment Rating Methodology (HARM).

This report presents the findings of the above activities.

1.4 METHODOLOGY

The methodology used for this Phase I investigation was that specified by the Air Force as shown in Figure 1-2. The investigation was conducted by

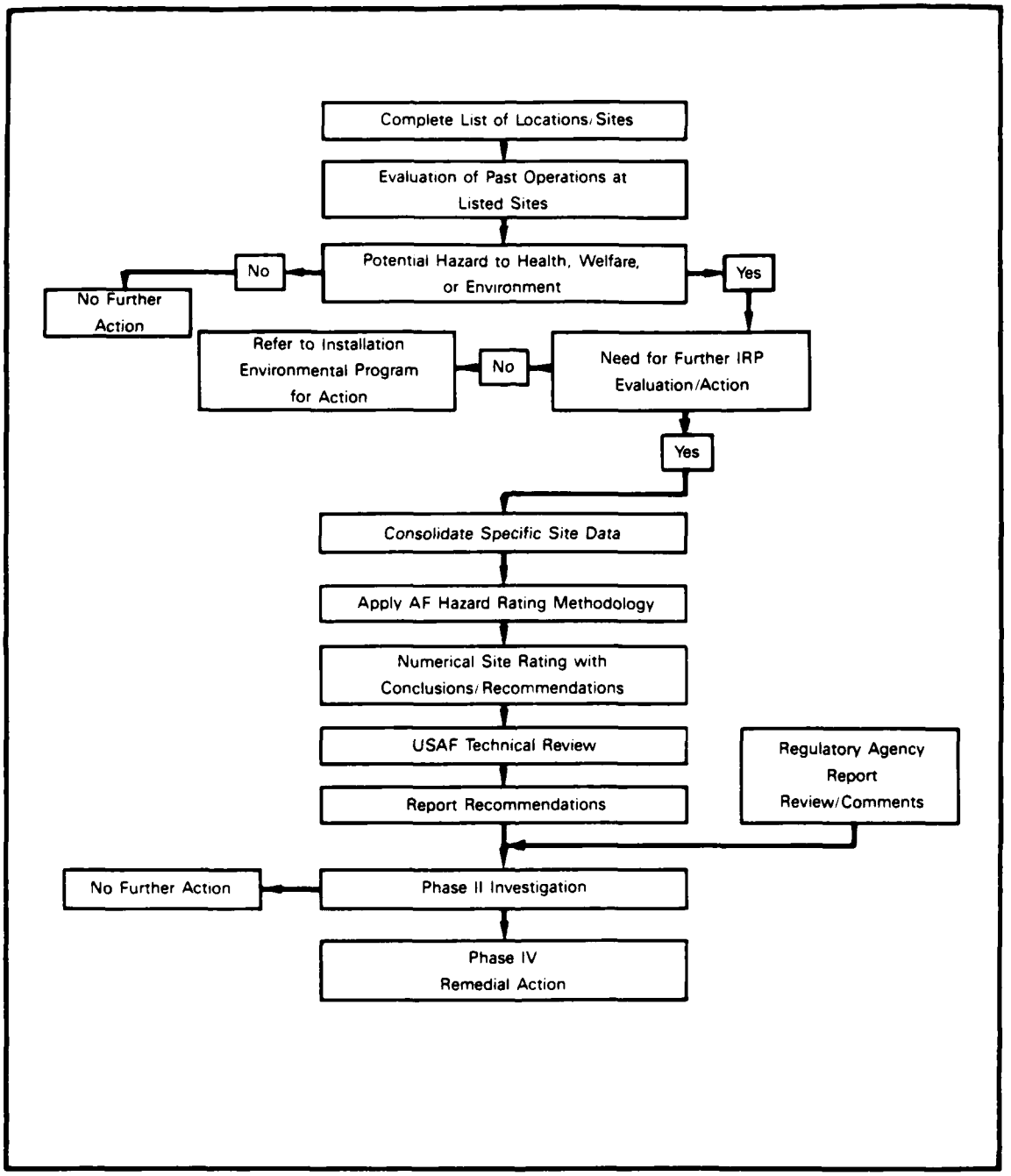


Figure 1-2. IRP Phase I Records Search Flow Chart

Science Applications International Corporation (SAIC). The following team of professionals conducted this investigation:

- Ms. Jennifer Bramlett; Task Manager, Environmental Scientist, and Field Team Member
- Dr. Edward Repa; Senior Hydrologist and Field Team Member
- Mr. Josh Margolis; Environmental Scientist and Field Team Member
- Ms. Claudia Furman, Geologist
- Mr. Shahid Mahmud, Chemical Engineer.

Resumes for these professionals are provided in Appendix A.

The Phase I investigation began with a review of information on AFP 44 gathered from AFSC and facility personnel during a government-owned, contractor-operated (GOCO) facility environmental audit conducted in 1983. Retired records were sent from AFSC archives to AFP 44 for review during the site visit of November 12 through 16, 1984. During this site visit, the field team conducted a tour of the facility, reviewed facility activities, conducted file searches, and interviewed employees involved in various facility operations.

Concurrent with site visit interviews and records reviews, appropriate Federal, state, and local offices were contacted for information regarding activities at AFP 44, environmental setting data, and other available pertinent information. Appendix B provides a complete list of outside agency contacts made as part of this investigation.

The team additionally reviewed previous record searches and investigations conducted by the AF, Hughes, and the EPA. The team also reviewed IRP Phase II documentation relating to the CERCLA response at AFP 44. These investigations and relevant documents included the following:

- Field Investigation Team (FIT) Preliminary Site Inspection Report for AFP 44

- Stage I and Stage II Investigation Reports (Phase II documentation) of Subsurface Conditions in the Vicinity of AFP 44
- Interim Report on the Digital Simulation of Contaminant Transport in the Regional Aquifer System of AFP 44
- Summaries of the 1982 and 1983 Hydrologic Monitoring Programs at AFP 44
- An Analysis and an Evaluation of Data Collected by the Tucson Groundwater Contamination Study Task Force
- Annual Generator's Reports and Quarterly Reports from AFP 44 to ADHS.

Appendix D contains a complete listing of references cited in this report.

Sites with the potential for environmental contamination were identified from these investigations, interviews, and record review activities. Each site was assessed for its potential to have caused environmental contamination, based on available data. If the potential for environmental contamination and contaminant migration existed, the site was evaluated and prioritized using the Air Force's Hazard Assessment Rating Methodology (HARM). The rating methodology and site rating results are provided in Appendices E and F, respectively.

IRP activities are ongoing at AFP 44, and a remedial action plan is currently (October 1985) in the public review and comment stage. This Phase I report makes some recommendations regarding the continuance of environmental monitoring and the implementation of remedial actions.

2.0 INSTALLATION DESCRIPTION

2.1 LOCATION

Air Force Plant 44 (AFP 44) is located geographically near Tucson, Arizona at latitude 32° 06' 00" and longitude 110° 55' 44". The plant is located 15 miles south of downtown Tucson, immediately south of Tucson International Airport, and approximately one mile east of Nogales Highway (Route 89). Other sites of interest in the vicinity of the facility include: the San Xavier Indian Reservation (west of Route 89), Davis-Monthan Air Force Base (approximately 3 miles to the northeast), the Saguaro National Monuments (approximately 10 miles to the northeast and 15 miles to the northwest), and the Santa Rita Experimental Range (approximately 12 miles to the south). Figures 2-1 and 2-2 show the regional and area locations of AFP 44, respectively.

Hughes Aircraft Company is and has been the only contract operator of AFP 44. Industrial facilities at AFP 44 presently occupy a total building area of 1,061,104 square feet. In total, AFP 44 encompasses 2,258 acres.

2.2 PLANT HISTORY

AFP 44 was first constructed by Hughes in 1951 for the purpose of producing the Falcon family of air-to-air missiles for the Air Force. In 1954, the facility was expanded with the installation of a Final Assembly and Checkout (FACO) Facility for the purpose of arming products to an operationally ready configuration.

Figure 2-3 identifies both the historical maximum and current boundaries of AFP 44. The facility was purchased from Hughes by the U.S. Government in 1951. The maximum boundary remained the same from 1951 to 1958, when a portion was deeded to Tucson Airport Authority (HAC General Site Plan, 1961). The boundaries have not changed since 1958. The facility has continued production of sophisticated, small- to medium-size, air-to-air, air-to-ground, and ground-to-ground guided missiles. Table 2-1 outlines the history of programs at AFP 44.

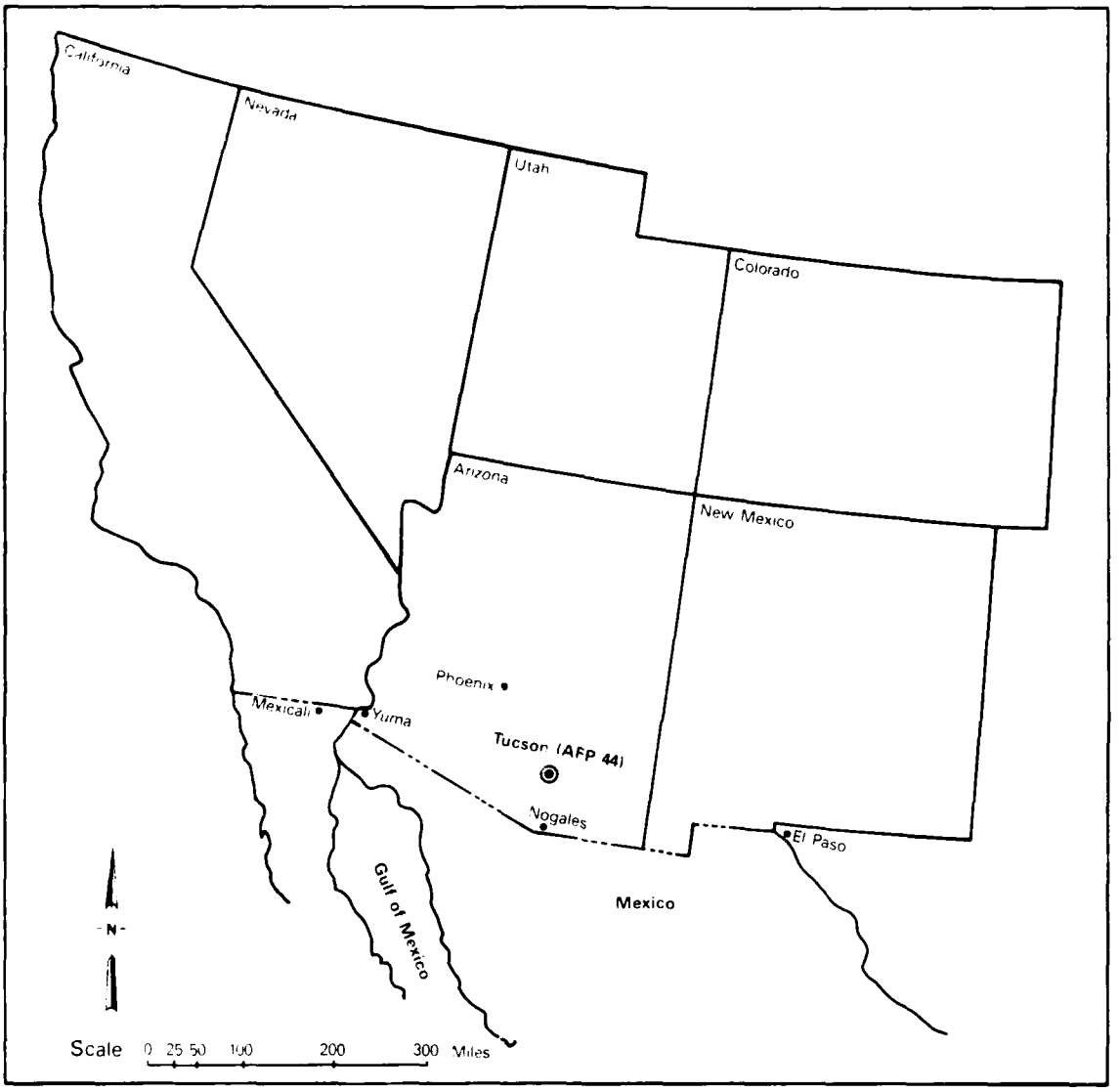


Figure 2-1. Regional Location of AFP 44, Tucson, Arizona

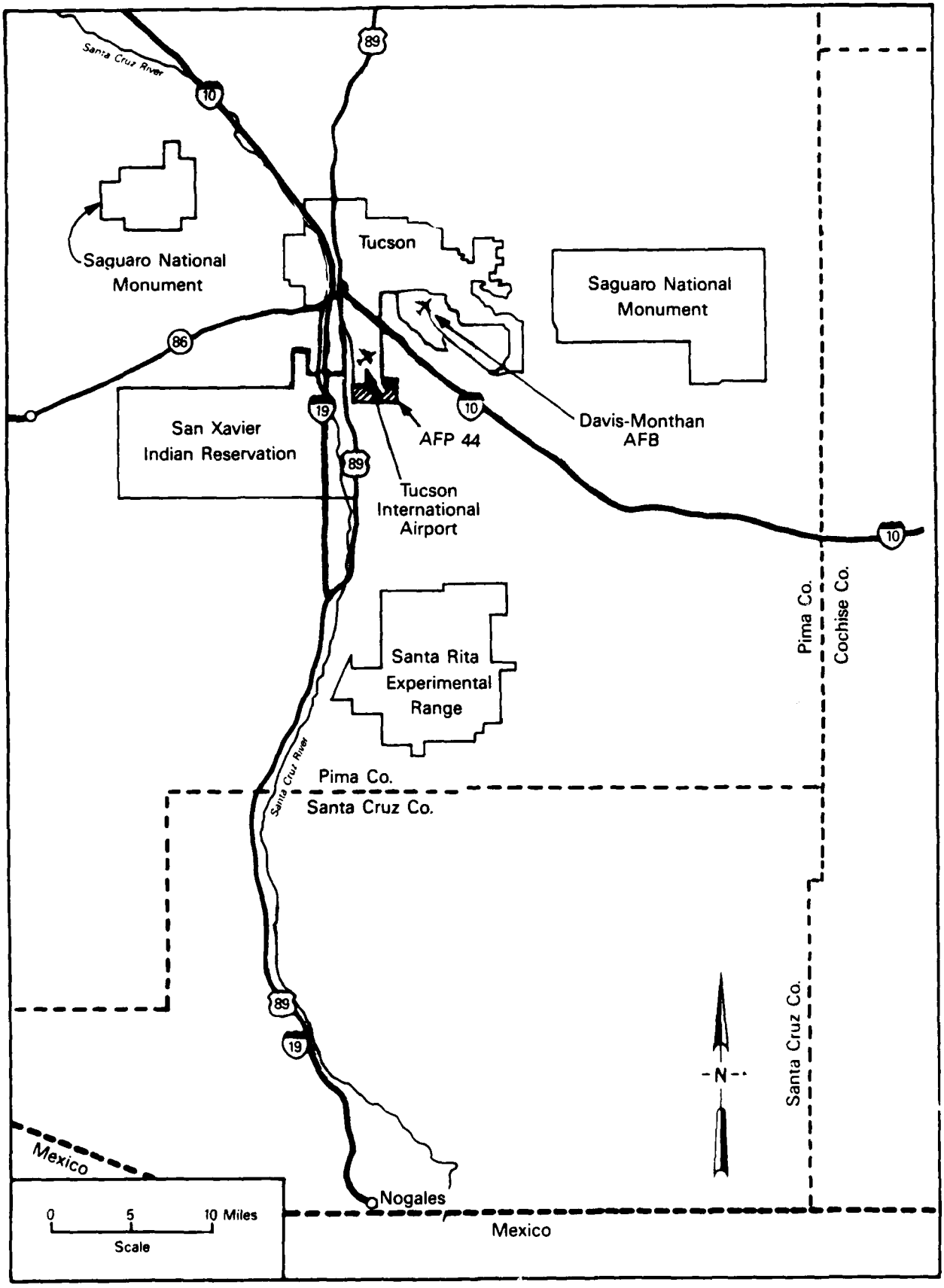
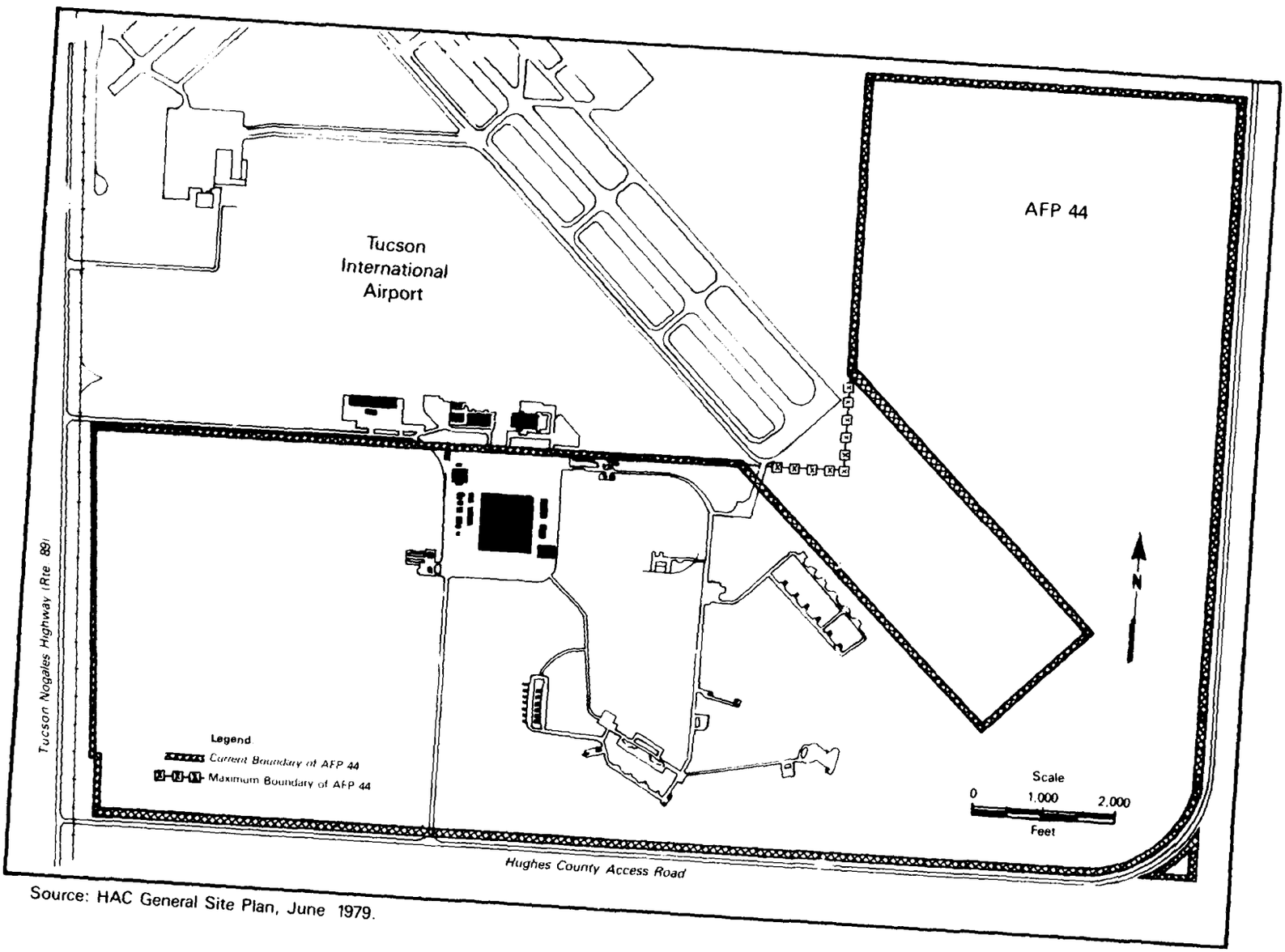


Figure 2-2. Location of AFP 44 in Tucson Area, Arizona



Source: HAC General Site Plan, June 1979.

Figure 2-3. Current and Maximum Boundaries of AFP 44, Tucson, Arizona

Table 2-1. HISTORY OF PROGRAMS AT AFP 44

Program	Period of Operations	DOD Entity
Falcon	1951-1963	Air Force
57IN	1963-1968	Air Force
HM-555 and Taran	1963-1968	Air Force
Falcon Air Intercept Missile (AIM) - 4D Missiles & Launchers	1965-1971	Air Force
Falcon AIM 4B and 4C	1968	Air Force
Walleye Glide Bomb (AGM-62A)	1969-1971	Navy
Roland Missile	1974-1981	Army
Fighting Vehicle System	1980-1982	Army
Army Tracked Optically, Wire-guided (TOW) Missile	1965-Present	Army
Lightweight Rocket Launcher	1978-Present	Army
Maverick Missile and Launcher	1968-Present	Air Force and Navy
Phoenix Missile and Launcher	1968-Present	Navy
Angle Rate Bombing System (ARB3)	1980-Present	Navy and Marines
Advanced Medium Range Air-to-Air Missile (AMRAAM)	1982-Present	Air Force and Navy

Source: HAC, 1984.

2.3 ORGANIZATION AND CURRENT ACTIVITIES

Hughes Aircraft Company operates AFP 44 under a facilities contract with the Air Force Aeronautical Systems Division (ASD), Wright-Patterson Air Force Base, Ohio. Hughes' operations at AFP 44 center around the manufacture, component research, development, and testing of five missile systems for the Air Force, Army, and Navy. Specifically, the following systems and components are produced: Phoenix missile launcher and auxiliary system; Tracked Optically, Wire-guided (TOW) missile; Maverick missile and launcher; Angle Rate Bombing (ARB) System; and Advanced Medium Range Air-to-Air Missile (AMRAAM). Support operations have included equipment cleaning, general maintenance, and engine test firing (JRB, 1983). Hughes currently employs 8000 personnel, working on three shifts. The third shift consists of a skeleton crew of emergency response and maintenance personnel. Additionally, the U.S. Government maintains a presence at the Air Force Plant Representative's Office (AFPRO) which is responsible for the administration of DOD acquisition contracts and the Air Force facilities contract.

Table 2-2 lists the current and past activities of occupied buildings at AFP 44. Figure 2-4 illustrates the locations of major buildings. The buildings located north of the plant's boundary are owned or leased by Hughes, and situated on land owned by the Tucson Airport Authority.

Table 2-2. CURRENT AND PAST ACTIVITIES IN BUILDINGS AT AIR FORCE PLANT 44

Building Number	Building Name	Date of Activation	Current Activities	Past Activities Different from Current
801	Main Manufacturing Building	November 1952	Machine shops, assembly shops, process shops, AFPRO and Hughes offices.	Contained heat treatment, deburr, etch circuitry and paint shops that have been moved to Buildings 810 (etch circuitry) and 814. Housed batch and flow-through wastewater treatment.
809	Hybrid Building	August 1983	Electronic assembly shops (microcircuitry), offices.	
810	Etch Circuitry Building	May 1983	Etch circuitry shop, electroplating, bonding, and cleaning operations, offices.	
812 and 813	FACO Test Buildings	October 1958	TOW rocket motor testing.	
814	Process Building	June 1984	Heat treatment shop, plastic shop, painting shop, deburr shop, and offices.	
815 Series	Zero-discharge Wastewater Treatment Plant (WWTP) 815 - Control Building for WWTP 815A - WWTP Filter Building with offices and controls	April 1977	Treatment of all industrial wastewaters and waste plating solutions. Also, chemical container rinse area (activated in 1984).	

Table 2-2. CURRENT AND PAST ACTIVITIES IN BUILDINGS AT AIR FORCE PLANT 44 (Continued)

Building Number	Building Name	Date of Activation	Current Activities	Past Activities Different from Current
816	Maintenance Building	January 1978	Maintenance machine shop, maintenance paint shop, and offices.	
817	Chemical Storage Building	October 1976	Storage of both bulk and packaged non-flammable raw materials.	
819	Salvage Area	November 1952	Storage of salvaged materials.	
820 through 822	FACO Lunchrooms	February 1974	Lunchrooms.	
823	Emergency Generator House	April 1955	Housing of constant-current transformer and air dryer for telephone splices.	Housed emergency generator for taxiway lights.
824	Equipment Building	December 1956	Storage of safety and signal equipment for taxiway, e.g., traffic cones.	
825	Storage Building	April 1955	Storage of miscellaneous materials.	
826	Acid Storage Building	June 1961	Storage of acids.	

Table 2-2. CURRENT AND PAST ACTIVITIES IN BUILDINGS AT AIR FORCE PLANT 44 (Continued)

Building Number	Building Name	Date of Activation	Current Activities	Past Activities Different from Current
827	Cylinder Storage Building	June 1961	Storage of gas cylinders.	
828	Plant Protection Building (Fire Department)	June 1956	Fire department, lockers, communication center, and offices.	
829	Flammable Storage Building	September 1954	Storage of flammable raw materials and flammable wastes awaiting off-site disposal.	
829A	Control Valve House	August 1956	Housing of control valve for flammable storage deluge system.	
829B	Gate House	August 1956 (estimated)	Office space for flammable stores dispatcher.	
830	Maintenance Building	April 1955	Cabinet shop, paint shop, sheet metal shop, and welding shop.	Inert storage building until 1954.
831	Maintenance Material Storage	September 1977 (estimated)	Storage of materials to support maintenance activities in Building 830, e.g., sheet metal.	

Table 2-2. CURRENT AND PAST ACTIVITIES IN BUILDINGS AT AIR FORCE PLANT 44 (Continued)

Building Number	Building Name	Date of Activation	Current Activities	Past Activities Different from Current
833	Utility Building (for Building 801)	November 1952	Refrigeration compressors.	Carport.
834 and 835	Main Cooling Towers	November 1952	Cooling.	
836	Main Electrical Substation	November 1952	Distribution of power and housing of transformers.	
837	Water Reservoir and Fire Pump House	November 1952	Water for fire protection.	Water for domestic use.
838	Domestic Water Pump House	November 1952	Not in use; houses monitoring well.	Water for domestic use and fire protection.
839	Sewer Meter House	November 1952	Housing of meter for sanitary sewer flow from manufacturing area.	
851	FACO Administration Building	April 1955	Offices and lunchroom.	
852 to 856	Missile Assembly and Test Building	April 1955	Missile assembly and testing.	
861	FACO Water Tower	June 1962	Water for firefighting.	
862	Missile Assembly and Test Building	March 1972	Missile assembly and testing.	

Table 2-2. CURRENT AND PAST ACTIVITIES IN BUILDINGS AT AIR FORCE PLANT 44 (Continued)

Building Number	Building Name	Date of Activation	Current Activities	Past Activities Different from Current
864	Missile Assembly and Test	August 1972	Missile assembly and testing.	
865	Missile Test Site (TOW)	February 1976	Shipping and receiving of parts and explosives.	
866	Shipping and Receiving Facility	February 1976	FACO loading dock.	
867	Inert Storage Shed	October 1976	Storage of inert materials.	
870	Missile Shipping and Receiving and Missile Disassembly Facility	April 1955	Shipping, receiving, and disassembly of missile parts.	
857 through 860 871 through 880	Storage Magazines	April 1955	Storage of missiles, missile components, and explosives.	
881 through 894	Storage Magazines	September 1974	Storage of missiles, missile components, and explosives.	
895 through 897	Storage Magazines	August 1975	Storage of missiles, missile components and explosives.	

Source: HAC, 1984.

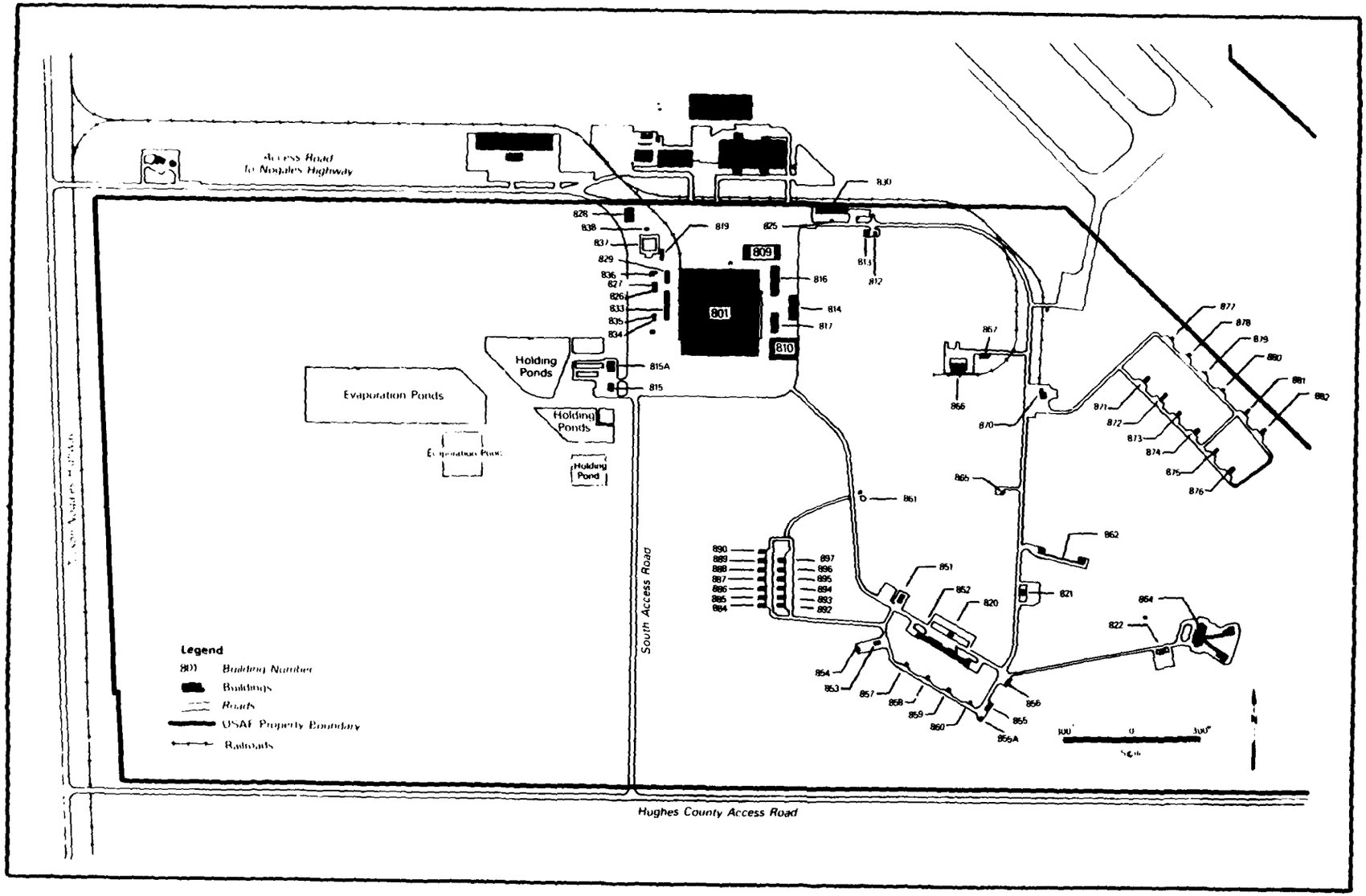


Figure 2-4. Major Buildings Located at AFP 44, Tucson, Arizona

3.0 ENVIRONMENTAL SETTING

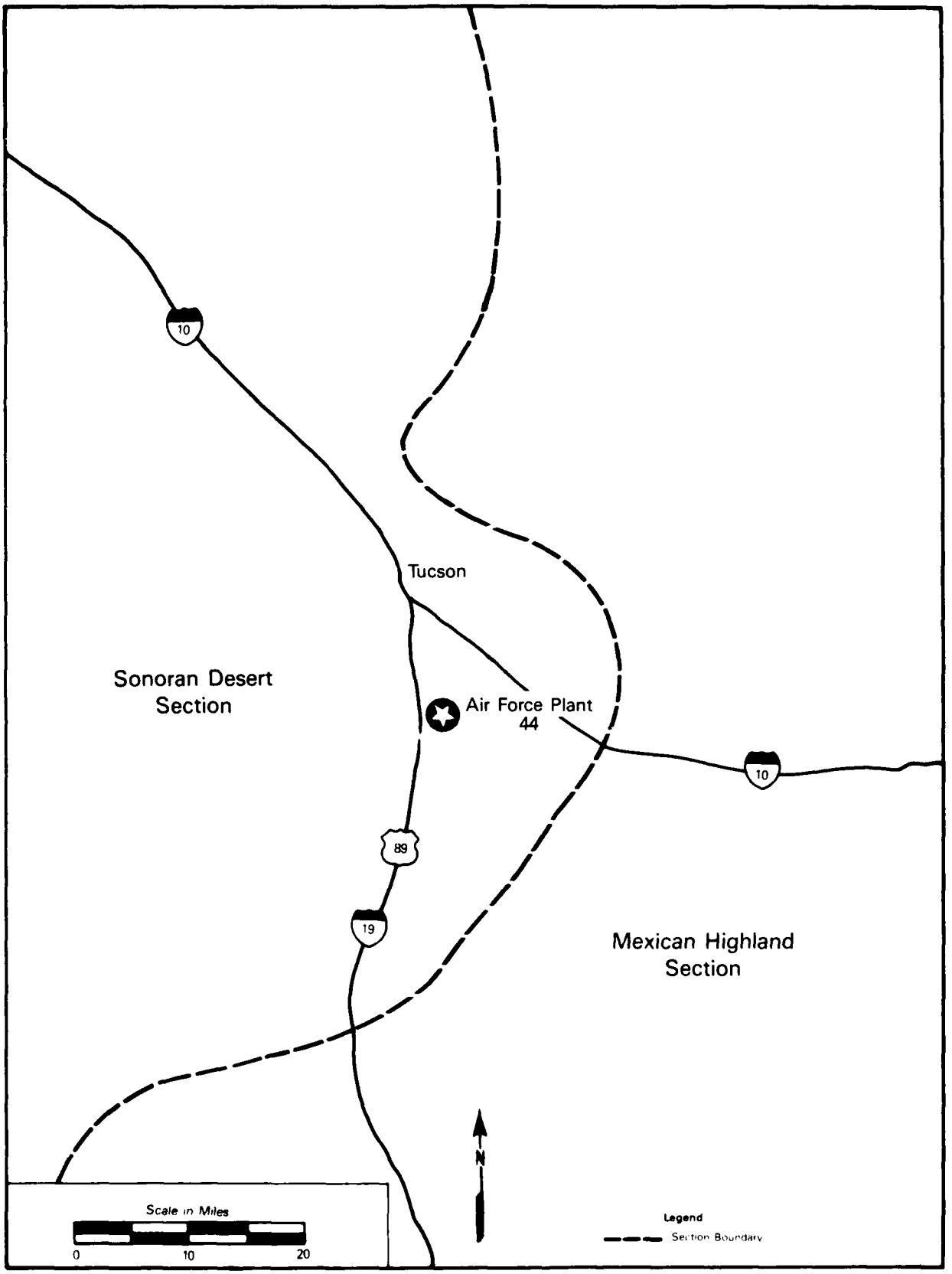
This section presents a summary of the environmental setting of Air Force Plant 44 (AFP 44). The section focuses on the geologic, hydrologic, and ecologic conditions that influence the movement of hazardous materials in the environment or that may be adversely affected by the presence of hazardous materials.

3.1 GEOGRAPHY AND TOPOGRAPHY

AFP 44 is located within the Sonoran Desert section of the Basin and Range physiographic province as shown in Figure 3-1. The province is generally characterized by north- to northwest-trending isolated mountain ranges separated by either desert plains or basins. AFP 44 is located in one of these basins referred to as the Tucson Basin. This basin is a broad 1,000 square mile area in the upper Santa Cruz River drainage basin. The basin is partially surrounded by mountain ranges, including the Santa Rita, Empire, Rincon, Tanque Verde, Santa Catalina, Tortolita, Sierrita, Black, and Tucson Mountains. The eastern and northern ranges are at altitudes between 6,000 and 8,000 feet above mean sea level (msl), with peaks at altitudes greater than 9,000 feet msl. The ranges to the west are between 3,000 and 6,000 feet msl (CH2M Hill, 1982). AFP 44 itself is located at an altitude of approximately 2,600 feet msl on a relatively flat terrain. Elevations across plant property range from 2,570 feet msl at the northwest corner to 2,630 feet msl near the southeast corner. The 60-foot difference in elevation occurs over a distance of 2 miles, indicating a surface slope of less than one percent towards the northwest (E&E, 1981).

3.2 METEOROLOGY

The general climate of AFP 44 is characterized by warm semi-arid conditions, common for much of the southwestern United States. Climatic factors are largely influenced by a latitudinal high pressure zone, distance from major water bodies, and the presence of mountain ranges partially surrounding the plant area (CH2M Hill, 1982).



Source: CH2M Hill, 1982

Figure 3-1. Physiographic Location of AFP 44 in the Basin and Range Province

The summer season is long and hot, extending from April through October, with an annual average of 41 days with maximum temperatures above 100°F. Some relief from high temperatures, however, is provided by an associated low average relative humidity of 37 percent. Under usual conditions, the diurnal temperature range is large, averaging almost 30°F, although it may exceed 40°F. Clear skies or very thin high clouds permit intense surface heating during the day and active radiational cooling at night, a process enhanced by the characteristic atmospheric dryness (NOAA, 1981). The short winter season, which extends from November through the month of March, is characterized by clear, mild weather with intermittent periods of overcast sky. The average monthly temperatures during the winter months range between approximately 54°F to 62°F. The annual average temperature for the AFP 44 area is about 68°F, with average daily maximum and minimum temperatures of 82°F and 54°F, respectively.

Precipitation at AFP 44 averages about 11 inches per year with more than 50 percent occurring between July and September in the form of high intensity, short duration summer thunderstorms, usually in small areas. A secondary precipitation maximum occurs between December and March, when frontal storms produce widespread precipitation and provide 20 percent of the yearly precipitation. Winter precipitation is generally less intense than summer precipitation, but is of longer duration. The months of April, May, and June are typically the driest, with less than 0.5 inches of precipitation per month. The mean annual lake evaporation rate in the Tucson area is approximately 65 inches per year. The net precipitation for the AFP 44 area (mean annual precipitation minus mean annual evaporation) is approximately minus 55 inches per year, which provides a low driving force for contaminant migration. Table 3-1 summarizes monthly and yearly temperature and precipitation data for the AFP 44 area.

Wind patterns are influenced to a large degree by the surrounding mountains, as well as by the general slope of the terrain. Prevailing winds are from the southeast during much of the year. However, variable temperature gradients between the adjacent mountains and the basin floor result in diurnal pattern changes, with winds from the west and northwest during the day and

Table 3-1. METEOROLOGICAL DATA SUMMARY FOR THE TUCSON INTERNATIONAL AIRPORT AREA, TUCSON, ARIZONA

Parameter	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
Temperature[a] (°F)													
Highest	87	92	92	102	107	111	111	109	107	101	90	84	111
Average Daily Maximum	64	67	72	81	90	98	98	95	93	84	72	65	82
Average Daily Minimum	38	40	44	50	58	66	74	72	67	56	45	39	54
Lowest	16	20	20	27	38	47	63	61	44	26	24	16	16
Precipitation													
Rainfall[a]													
Mean (inches)	0.82	0.82	0.73	0.35	0.19	0.26	2.25	2.08	1.28	0.64	0.75	1.00	11.17
Snowfall[b]													
Mean (inches)	0.3	0.3	0.2	0.3	0.1	0.0	0.0	0.0	0.0	0.0	T[c]	0.2	1.4

Source: NOAA, 1981

[a]Period of Record, 1900-1981.

[b]Period of Record, 1941-1981.

[c]"T" denotes less than 0.05 inch.

from the southeast at night and during dawn hours. Average winds are typically less than 10 miles per hour in the plant area; however, a maximum speed of 71 miles per hour has been recorded at the Tucson International Airport (NOAA, 1981).

3.3 SURFACE HYDROLOGY

The Tucson Basin is drained by the Santa Cruz River, which flows in a northwesterly direction through the basin. In the vicinity of AFP 44, the river flows almost due north and is located approximately 1.5 miles west of the plant's western boundary (USGS, 1983). Major tributaries of the Santa Cruz River in the vicinity of AFP 44 include Julian Wash, Pantano Wash, Arroyo Wash, and Rillito Creek, all of which flow either in a westerly or northwesterly direction into or towards the Santa Cruz River.

The relatively small quantity and irregularity of rainfall in the Arizona desert results in erratic natural flows in the Santa Cruz River and its tributaries. These drainageways are dry most of the year and flow only during, and immediately following, rainstorms. To optimize surface water resources and concurrently prevent flood damage from infrequent but severe storms, many drainage channels have been constructed in the Tucson area.

Surface drainage in the AFP 44 area is controlled by two intermittent streams, a series of drainage channels, and a subsurface storm drain system. Generally, surface drainage across the plant property is in a west-northwesterly direction towards the Santa Cruz River, as shown in Figure 3-2. Of the two intermittent streams in the plant area; one, the Arroyo Wash, runs through the southern portion of the plant property, and the second stream runs from the Tucson International Airport and above the northwest corner of the plant property. The two streams meet and drain to the west toward Nogales Highway. From Nogales Highway, drainage is westerly toward the Santa Cruz River (E&E, 1981).

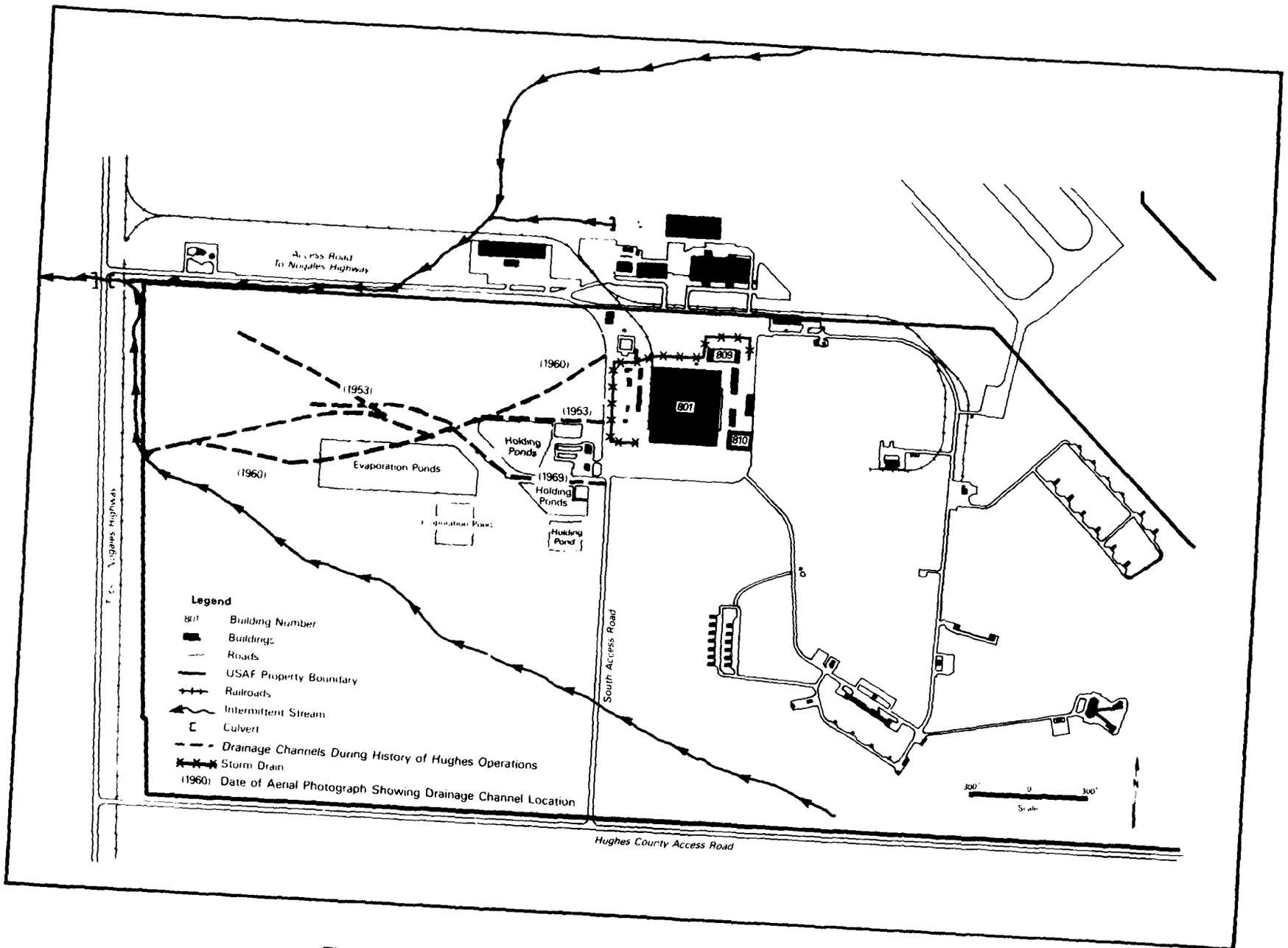


Figure 3-2. Surface Drainage at AFP 44, Tucson, Arizona

The storm drain system at AFP 44 serves to direct surface runoff from the main facility area to drainage channels located just west of Building 801. The drainage channels, in turn, direct surface water to the west, in the direction of the river.

3.4 SOILS

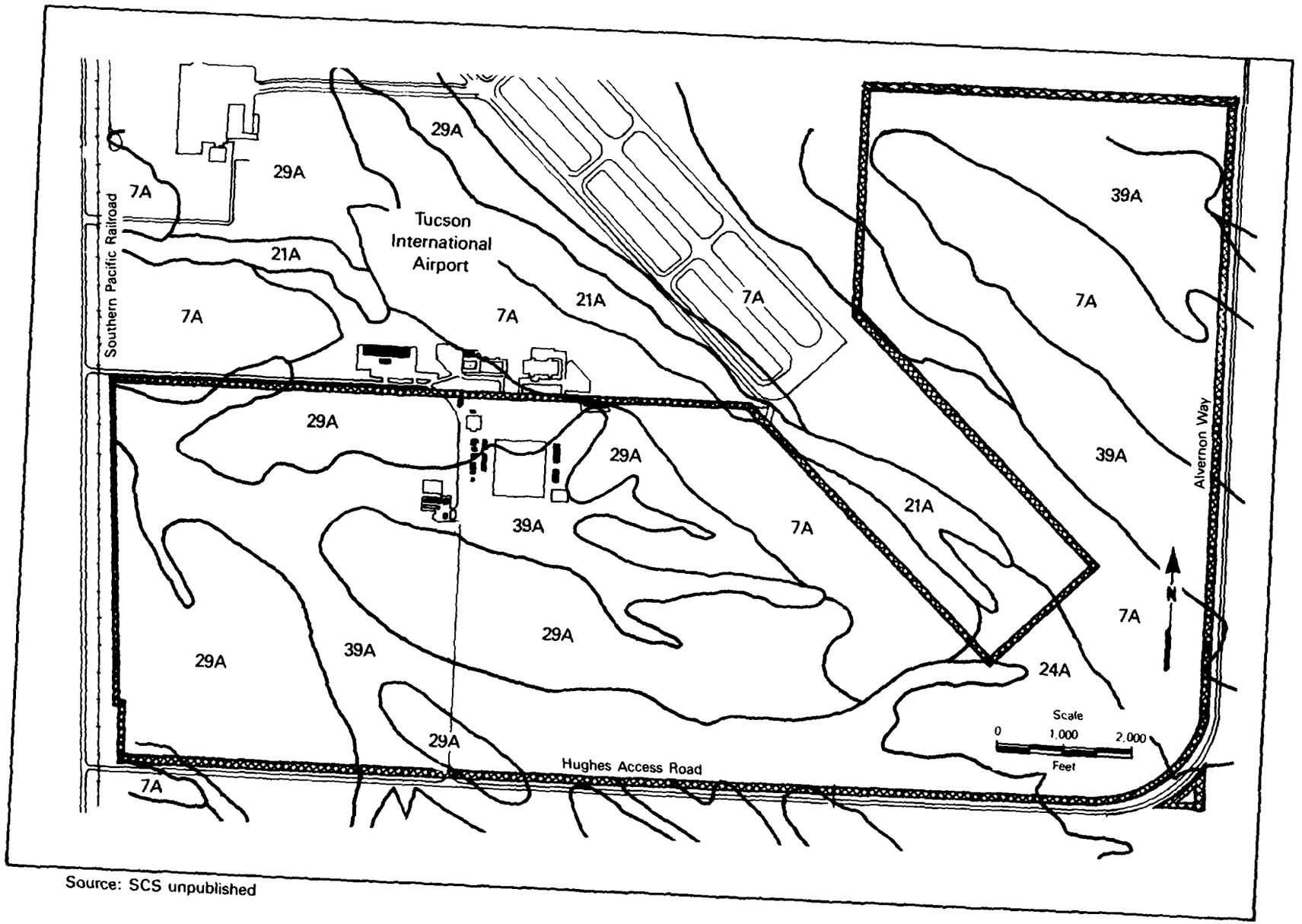
In a recently completed soil-mapping effort conducted by the Soil Conservation Service (SCS), five distinct soil series were identified and mapped in the vicinity of AFP 44. The following sections briefly describe each of the five series and Figure 3-3 illustrates their approximate boundaries and configurations in the immediate plant area (SCS, unpublished). This survey may not agree with older surveys because it was recently completed by the SCS. Additional characteristics of each soil type are presented in Table 3-2.

3.4.1 Cave Series (7A)

The Cave soil series consists of shallow, well-drained, moderately permeable soils. This soil type is most commonly formed in gravelly mixed alluvium on low hills and valley fill. Typically these soils have a pale brown, gravelly, sandy loam surface layer about 7 inches thick and a pink, gravelly, loam substratum 5 inches thick over indurated lime-cemented material, 18 inches thick. Finally, from 30 to 60 inches, there is light brown, weakly-cemented, gravelly, loamy sand. Cave soils are found along slopes between 0 and 8 percent.

3.4.2 Yaqui Series (21A)

The Yaqui series consists of deep, well-drained soils formed in mixed calcareous alluvium on alluvial fans. Typically these soils have strong, brown, fine, sandy loam surfaces that are about 4 inches thick. The subsoil is brown to dark brown sandy clay loam with a thickness of about 27 inches. At depths between 30 and 60 inches, the subsoil consists of a yellowish red clay loam in the upper portions, and a light brown gravelly loam in the lower portions. This soil type is found at slopes between 1 and 3 percent.



Source: SCS unpublished

Figure 3-3. Soil Type Distribution in the Vicinity of AFP 44, Tucson, Arizona

Table 3-2. PHYSICAL CHARACTERISTICS OF SOILS PRESENT AT AFP 44, TUCSON, ARIZONA

Soil Classification	Permeability (inches/hour)	Soil Reaction (pH)	Clay Content (Percent)
Cave (7A)	0.6-6.0	7.9-8.4	2-20
Yaqui (21A)	0.2-2.0	7.4-8.4	10-35
Nickel (24A)	0.2-20.0	7.9-9.0	3-10
Sahuarita (29A)	0.2-6.0	7.4-9.0	10-35
Riggs (39A)	<0.06	7.4-9.0	40-65

Source: SCS, unpublished

3.4.3 Nickel-Sahuarita Association (24A)

The Nickel series consists of deep, well-drained soils formed on dissected terraces in alluvium that originated from mixed rock sources. A typical profile of this soil material consists of two parts: (1) a light brown, gravelly, sandy loam surface layer that is about 7 inches thick, and (2) a light brownish-gray, very gravelly, sandy loam to a depth of 60 inches. These soils occur on slopes that are between 1 and 8 percent.

3.4.4 Sahuarita-Mohave Complex (29A)

The Sahuarita soil series consists of deep, well-drained soils formed on alluvial fan terraces in mixed calcareous alluvium. Typically, these soils have light yellowish brown, very gravelly, fine sandy loam surfaces that are about 3 inches thick. The next layer is about 25 inches thick and consists of light yellowish brown, fine sandy loam. Finally, the buried subsoil occurs at 28 to 60 inches below the surface and consists of loam and very gravelly sandy clay loam. These soils are most typically found on slopes that are between 1 and 5 percent.

3.4.5 Riggs Series (39A)

The Riggs soil series consists of deep, moderately well-drained, low permeability soils that form in mixed alluvium on alluvial fans and flood plains. This series typically has a brown clay surface layer about 6 inches thick, a mid-layer of brown clay subsoil 32 inches thick, and a brown and pink clay substratum with soft lime masses to 60 inches and more. The Riggs series is found along slopes between 0 and 1 percent.

3.5 GEOLOGY

Figure 3-4 illustrates the geology of the AFP 44 area. AFP 44 lies within the central area of an alluvium-filled basin that is partially surrounded by basement (crystalline) mountain ranges. In general, the source for alluvium is crystalline rock consisting of granite, granite-gneiss, schist, andesite, basalt, and limestone, which has eroded from the nearby mountains and has been transported by eolian and fluvial forces. These

deposits are generally unconsolidated sediments of variable thickness which were deposited during Pliocene and Quaternary time (less than 10 million years ago). Their thickness varies from just a few feet at the periphery of the Tucson Basin adjacent to the mountains, to greater than 5,000 feet in the central portion of the basin as shown in Figure 3-5. The unconsolidated sediments have been deposited on top of basement rock, which is probably of the same composition as the surrounding mountain ranges (CH2M Hill, 1982).

The alluvial deposits in the vicinity of AFP 44 are quite variable despite the fact that they were all derived from crystalline rock. The variability stems from the different depositional environments that existed. In general, most of the deposits were emplaced by running water which eroded the parent rock, transported the material toward the lowlands, and deposited them in the basin. The finer-grained sediments, such as silts and clays, were deposited at low water velocities during flood stages when rivers overflowed their banks. The finer-grained sediments were then deposited on the adjacent terrace or at the river mouth where alluvial fans were being formed. Coarser materials, i.e., sands and gravels, were deposited within the stream bed itself. These sediments were distributed laterally by the constantly changing stream course (CH2M Hill, 1982).

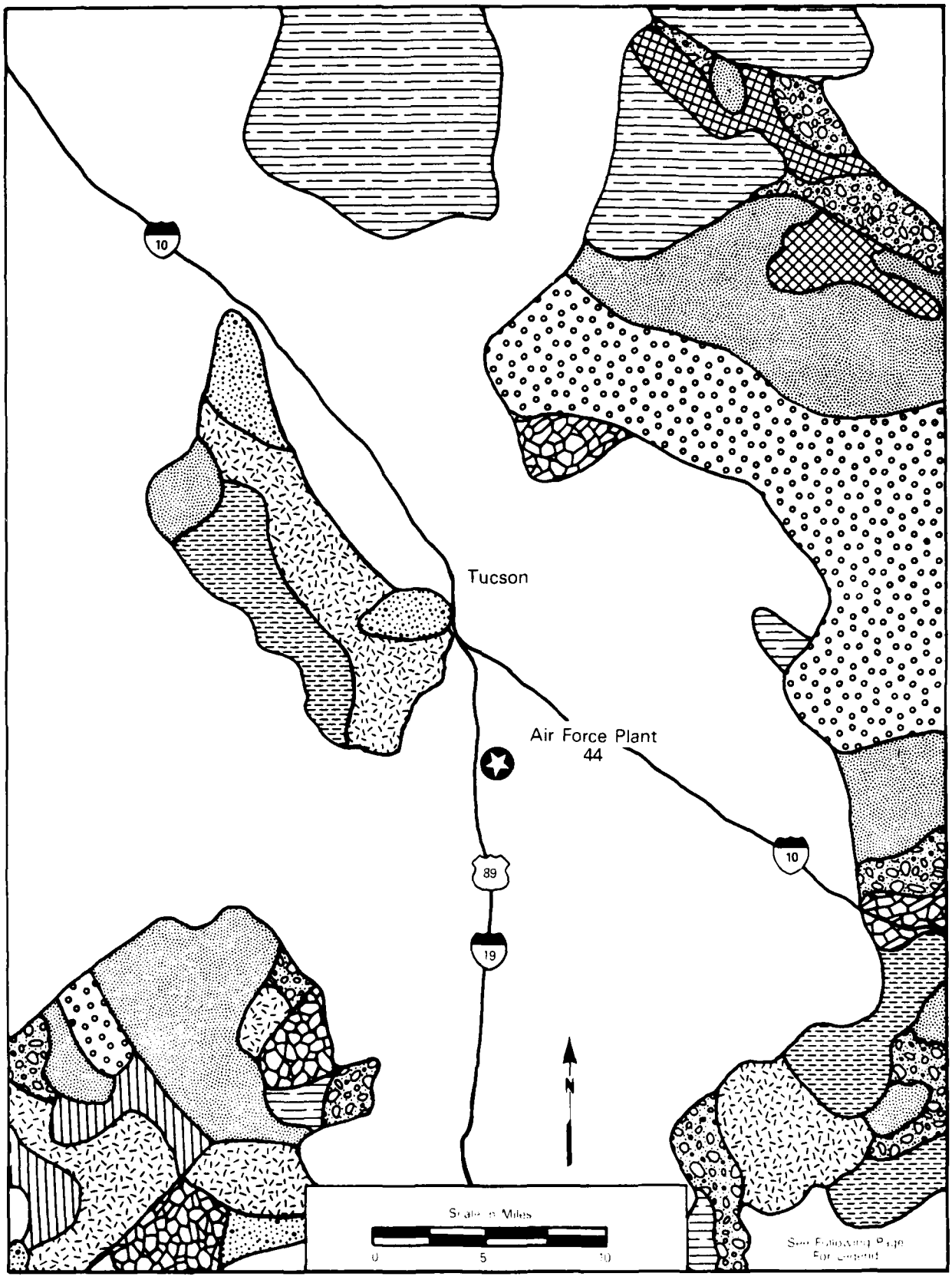
The alluvial sediments that were deposited in the basin and that underlie the AFP 44 area have been characterized as belonging to four sediment groups and these include, in descending order from the land surface: (1) surficial deposits, (2) Fort Lowell Formation, (3) Tinaja Beds, and (4) Pantano Formation (HMI, 1982a). Descriptions of these deposits are (HMI, 1982a):

- Surficial Deposits

  The surficial deposits overlie the Fort Lowell Formation and consist of terrace gravel, stream channel, and floodplain deposits. These thin deposits, comprising mainly of gravel and gravelly sand with localized sand and sandy silt, range in thickness from a featheredge to several tens of feet.

- Fort Lowell Formation

  The Fort Lowell Formation overlies the Tinaja Beds, and predominantly consists of silty gravel near the basin margins, grading into a silty sand and clayey silt toward the central part of the basin. These



Source: CH2M Hill, 1982

Figure 3-4. Geologic Map of Crystalline Bedrock, AFP 44, Tucson, Arizona

Legend to Figure 3-4

Sedimentary and Volcanic Rocks


Quaternary and Upper Tertiary (Pliocene) Sedimentary Rocks, Mostly Unconsolidated; Includes Scarce Lava and Silicic Tuff


Middle Tertiary (Miocene and Oligocene) Sedimentary Rocks; Locally Includes Lava and Tuff


Middle Tertiary Volcanic Rocks of Silicic to Basaltic Composition; Includes Related Intrusive Rocks


Cretaceous Sedimentary Rocks


Lower Tertiary to Triassic Volcanic Rocks; Includes Some Sedimentary Rocks


Mississippian through Cambrian Sedimentary Rocks on Colorado Plateau; All Paleozoic Sedimentary Rocks in Basin and Range Province


Younger Precambrian Sedimentary Rocks and Intrusive Diabase

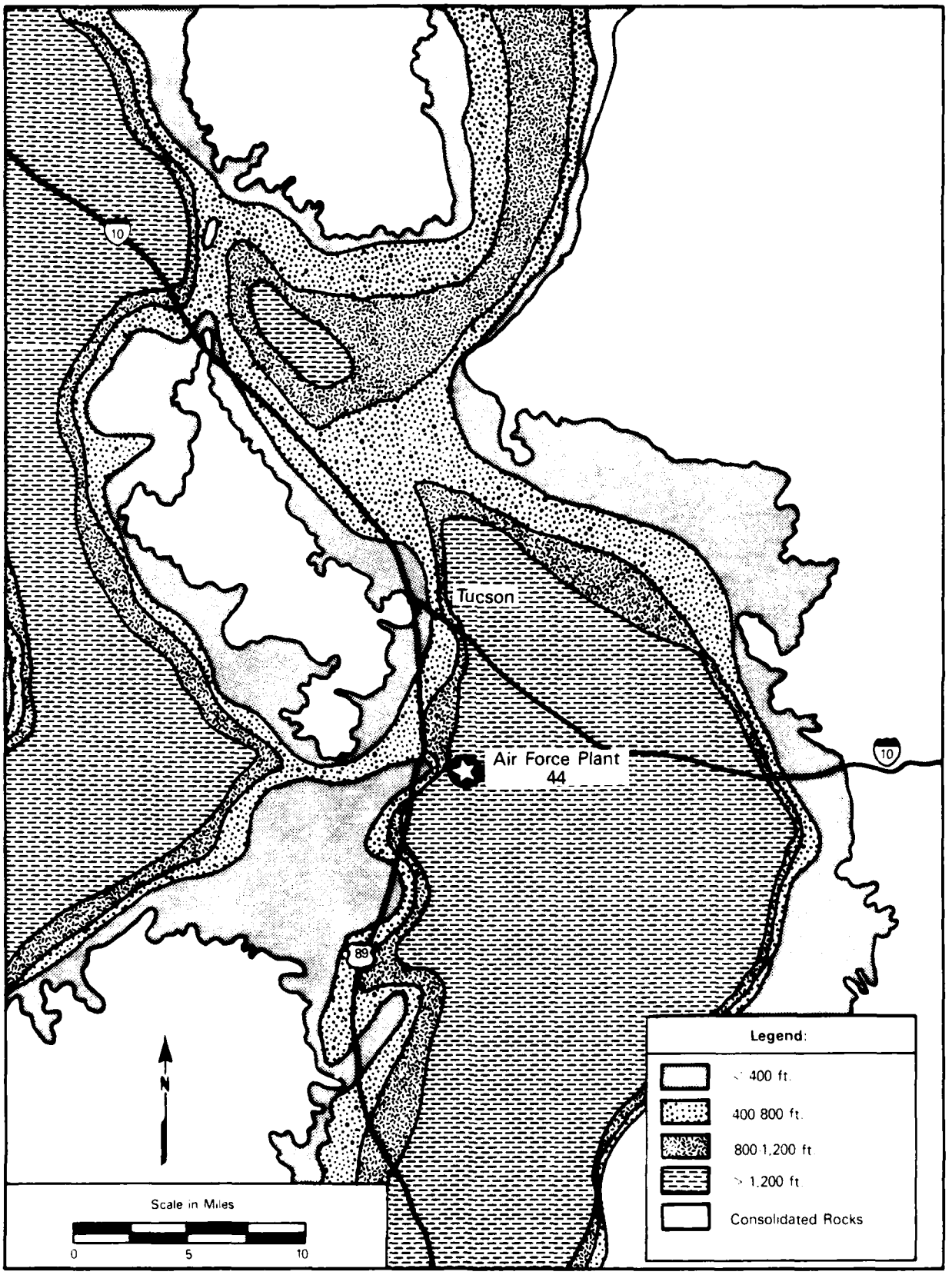

Older Precambrian Rocks of All Types Including Schist, Gneiss, and Fine-to Course-Grained Igneous Rocks

Metamorphic and Intrusive Igneous Rocks


Tertiary and Upper Cretaceous Intrusive Igneous Rocks


Mid-Cretaceous to Triassic Intrusive Igneous Rocks


Post-Paleozoic Gneiss and Schist



Source: CH2M Hill, 1982

Figure 3-5. Geologic Map Showing Distribution and Estimated Thickness of Unconsolidated Sediments in the Area of AFP 44, Tucson, Arizona

sediments are 300 to 400 feet thick near the basin's center, and thin out toward the mountains.

- Tinaja Beds

  The Tinaja Beds comprise sand and gravel at the basin's margins, and grade to gypsiferous, clayey silt and mudstone in the central portions of the basin. These beds range in thickness from a featheredge to as much as 5,000 feet.

- Pantano Formation

  The Pantano Formation is a reddish-brown, silty sandstone, which includes gravel with interbedded volcanic flows and tuffaceous sediments. The thickness of the Pantano is estimated to range from a few hundred to 1,000 feet.

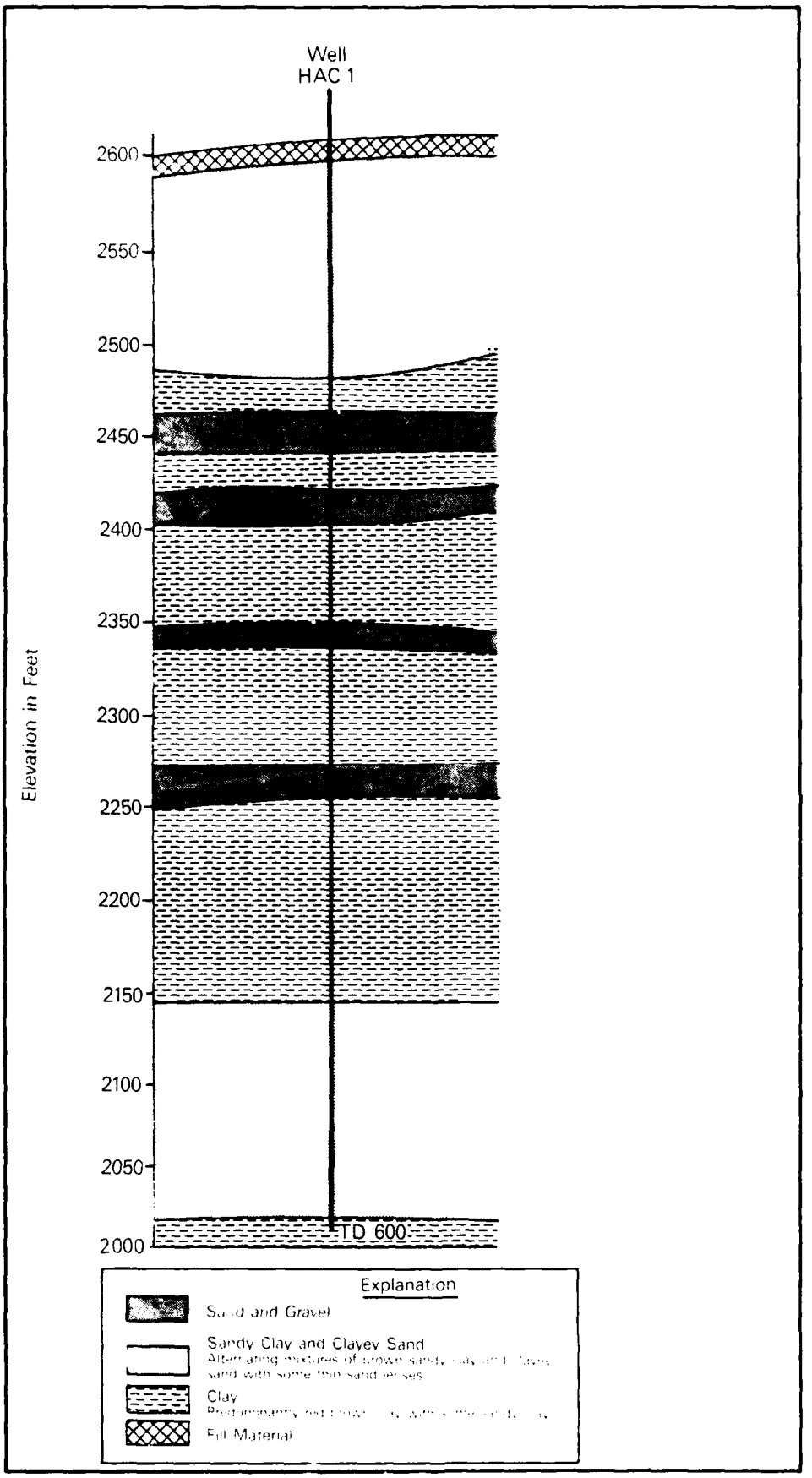
Based on previous studies and general area-wide geologic information, (HMI, 1982a; CH2M Hill, 1981), the uppermost 175 to 225 feet of alluvium underlying AFP 44 and the general vicinity is comprised of material belonging to the Fort Lowell Formation. The underlying clayey sediments, encountered to a depth of 600 feet, appear to correlate with the Tinaja Beds. The entire thickness of the Tinaja Beds has not been penetrated by exploratory boring on AFP 44 property and, therefore, the depth to the top of the underlying Pantano Formation is unknown.

The nature and distribution of geologic materials on AFP 44 have been further defined by samples obtained from soil borings and monitoring wells installed on-site, and from the interpretation of drilling logs. Figure 3-6 illustrates the geologic log of a well located on AFP 44 property in the central portion of the facility. The geologic cross-section provided by this log is typical of conditions found across the site.

3.6 WATER SUPPLY

Four production water wells were drilled at AFP 44 between 1952 and 1961 to supply all water for domestic and industrial purposes at the plant. These wells were designated HAC 1, HAC 2, HAC 3, and HAC 4.

HAC 1 was drilled to a depth of 400 feet in April 1952 and was deepened to 600 feet in August 1979. After the deepening operation, chromium



Source: Information extracted from HMI, 1982a.

Figure 3-6. Geologic Log for Well HAC 1, AFP 44, Tucson, Arizona.

concentrations approaching, but never exceeding, the EPA maximum level for drinking water was detected in the water supplied from HAC 1. HAC 1 was removed from service as a precautionary measure and has not been used as a domestic water supply well since August 1979. HAC 1 has been pumped only for the purpose of collecting groundwater samples. In 1982, the well was sealed with a cement slurry from approximately 600 feet to 250 feet below land surface to prevent any possible migration of contaminants from the upper aquifer zone to the lower aquifer zone through the well casing.

HAC 2 was drilled in July 1954 and cased to a depth of 504 feet, but was abandoned and capped in September 1954 because its production rate was too low to meet water supply needs at the plant. HAC 2 was never connected to the water system. In March 1983, the well was sealed from total well depth to 16 feet below land surface with a cement slurry.

When HAC 2 failed to meet required water demands in September 1954, HAC 3 was installed in October 1954 to a depth of 400 feet. HAC 3 provided water to AFP 44 until May 1981, when it was removed from service as a precautionary measure because trichloroethylene (TCE) had been detected in other AFP 44 wells. In tests conducted in August and September of 1981, TCE was not detected in HAC 3. In December 1984, HAC 3 was refitted to serve as a recharge well in a pilot groundwater reclamation program at AFP 44.

HAC 4 was completed to a depth of 450 feet below land surface in March 1961. HAC 4 was not connected to the water system but served solely to replenish the water tower that supplies the FACO fire protection system. In March 1983, the well was sealed from total well depth to three feet below land surface with a cement slurry.

All water used for domestic purposes at AFP 44 has been purchased from the City of Tucson since May 1981.

Other domestic (city and private) and industrial wells exist in the vicinity of the Tucson International Airport area which are not currently

utilizing the groundwater resources because they showed signs of contamination. The source of contaminants may have been multiple. The existence of groundwater contamination in the airport area resulted in the closure of seven city supply wells. The economic loss incurred by the city because of lost water production has been small (Valdez, 1985). Lost production has been made up by pumping less productive wells not affected by contamination.

3.7 GROUNDWATER HYDROLOGY

The thick sequence of alluvial sediments in the Tucson Basin forms a single hydraulically connected aquifer system. This regional aquifer system in the vicinity of AFP 44 has been defined by lithologic logs of AFP 44 water production wells, monitoring wells, and wells owned by the City of Tucson (HMI, 1982a). The regional aquifer system is comprised of an upper zone and a lower zone separated by a thick sequence of clayey sediments. A sandy clay zone also occurs intermittently above the regional water table. This sandy clay aquitard retards the vertical migration of liquids and causes perched groundwater to occur above the regional water table under AFP 44 (HMI, 1984b).

3.7.1 Perched Zone

The perched groundwater zone, comprised primarily of sandy clay and clay, overlies portions of the upper zone of the regional aquifer beneath AFP 44. This sandy clay zone pinches out north of the plant. The hydrogeologic relationship between the perched zone and the regional aquifer system is illustrated in cross-section on Figure 3-7. Location of the cross-section on Plant 44 is shown in Figure 3-8. The perched groundwater occurs under unconfined conditions at depths between 60 and 97 feet below the land surface (bls). The material that overlies this zone consists of unsaturated alluvial sediments comprised of alternating mixtures of sandy clay, clayey sand, gravelly sand, and caliche.

The sandy clay and clay zone acts as an aquitard and retards the vertical migration of fluids beneath AFP 44. This causes perched groundwater to develop beneath sources of percolating water. The surface area of the perched groundwater zone beneath the plant is approximately 100 acres, and has a

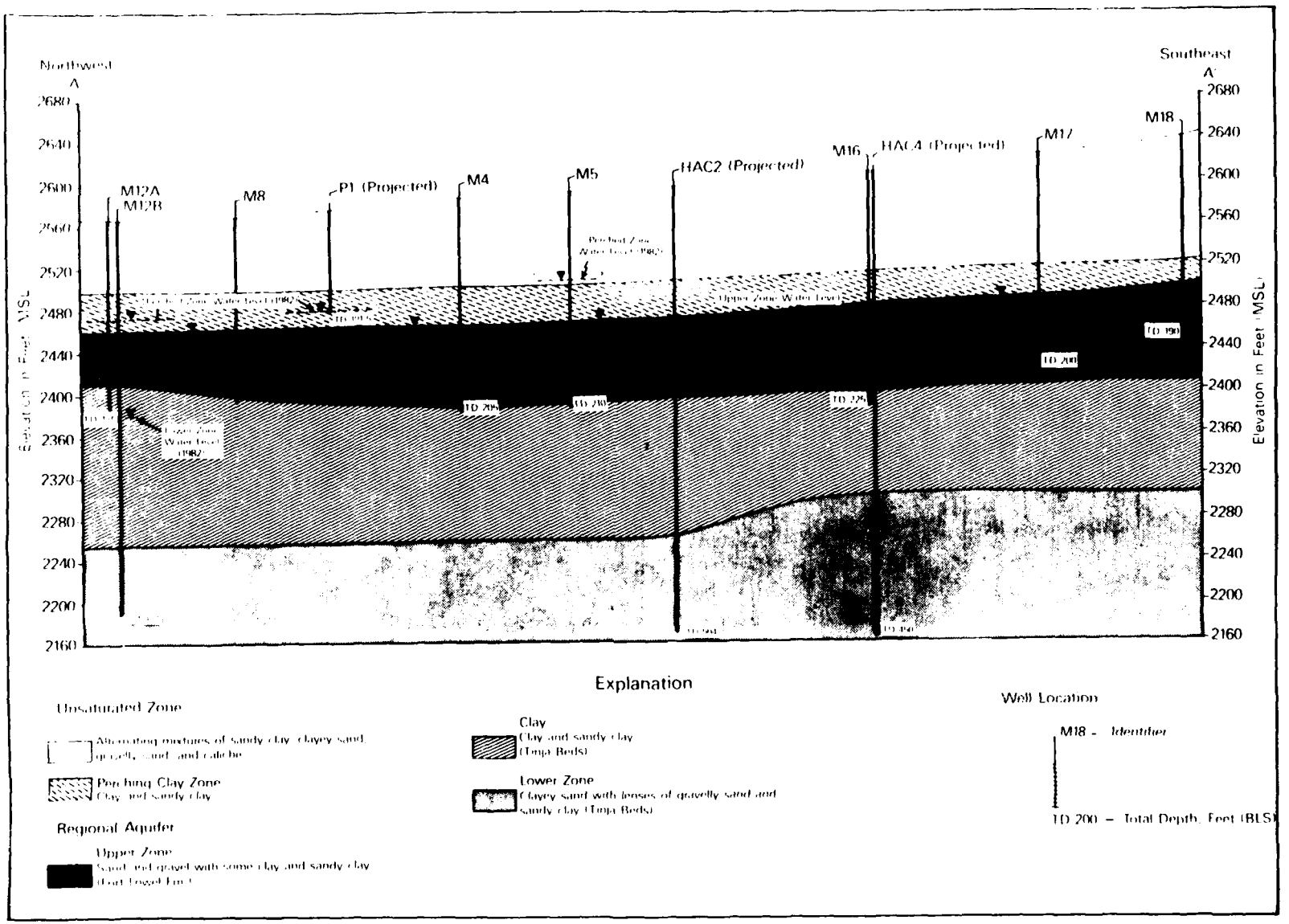
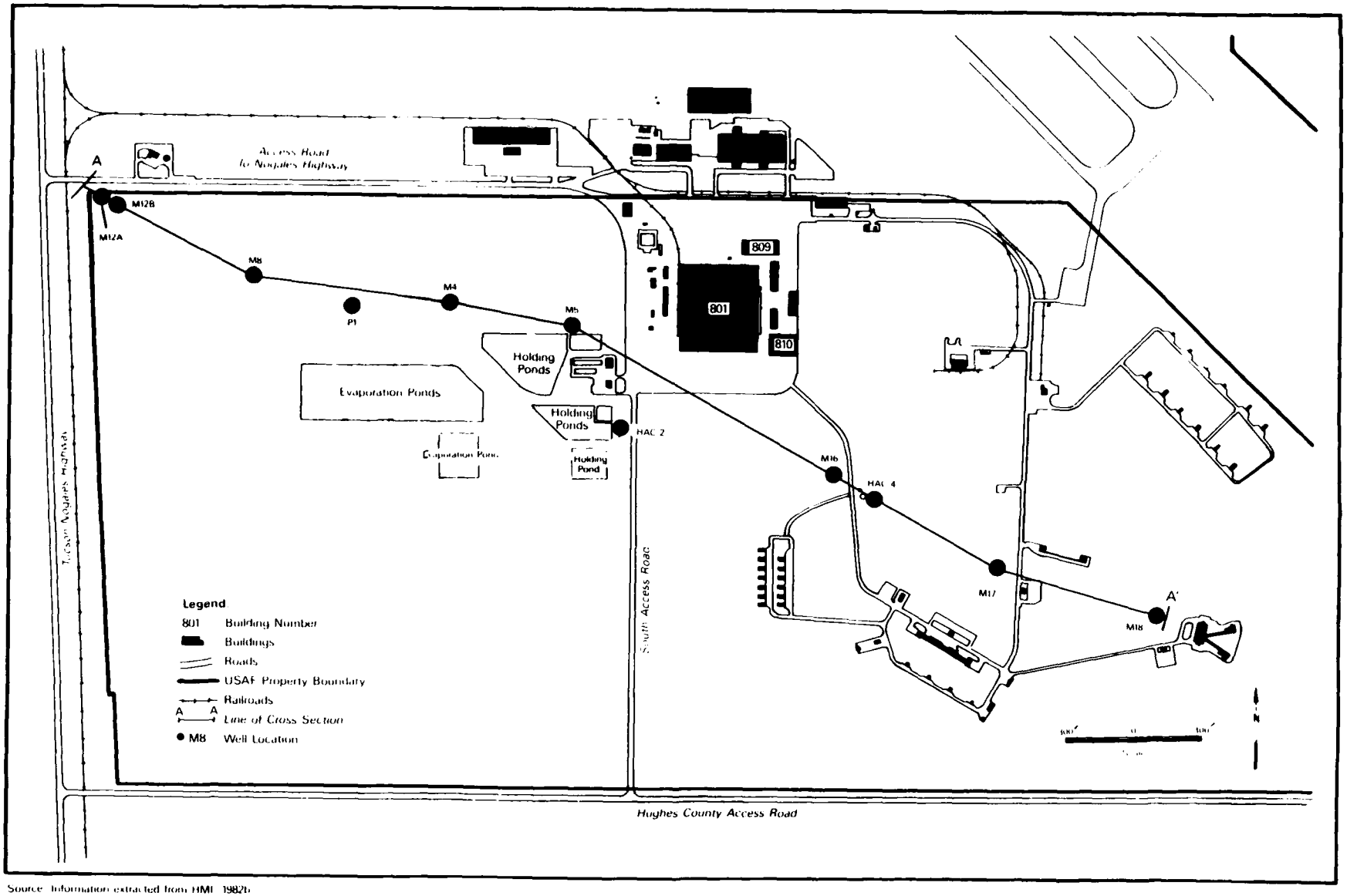


Figure 3-7. Geologic Cross-Section A-A' Across AFP 44, Tucson, Arizona (see Figure 3-8 for cross-section location)



Source: Information extracted from HMI 1982b

Figure 3-8. Location of Cross-Section Line A-A' at AFP 44, Tucson, Arizona (see Figure 3-7 *for cross-section)*

saturated thickness ranging from less than 1 foot to as much as 32 feet. Historical evidence suggested that potential sources of water to the perched groundwater zone included percolation of wastewater from former wastewater holding ponds and drainage channels, all of which were replaced with lined ponds in 1977. The current source of recharge to the perched groundwater zone is probably percolation of natural surface runoff (HMI, 1984b).

3.7.2 Regional Aquifer

The regional aquifer system, as previously stated, is comprised of two groundwater zones as shown in Figure 3-7. The upper groundwater zone consists of sand and gravel with some clay and sandy clay, and occurs approximately 100 feet bls. This zone is underlain by a relatively impermeable deposit of clay and sandy clay. The thickness of this clay material ranges between 50 and 100 feet across much of the plant property (Figure 3-7). Underlying the clay deposit is the lower zone of the regional aquifer. The lower zone consists of clayey sand with lenses of gravelly sand and sandy clay, and occurs at depths between 300 and 350 feet bls.

AFP 44 is hydrologically influenced by groundwater recharge at the Tucson basin periphery and by stream bed infiltration along the Santa Cruz River and its tributaries. The plant is within an area of comparatively high groundwater movement and recharge rates. However, groundwater levels in the Tucson area have been declining since the 1940s, in part because of pumping.

Depth to groundwater in the past varied from 60 to 80 feet bls. Recent water levels measured in AFP 44 production wells and monitoring wells completed in the upper aquifer zone indicate a current depth to groundwater ranging from about 100 to 140 feet bls. Water levels measured in wells completed in the lower aquifer zone indicate a depth to water ranging between 130 and 225 feet bls. The higher elevation of groundwater levels in the upper zone of the regional aquifer indicates that there is potential for the downward movement of groundwater (HMI, 1982a; HMI, 1984a). However, the upper

and lower aquifer zones are generally separated by a predominately clay and sandy clay sequence. This clay aquitard has a low permeability and thus retards the groundwater movement between the two zones (HMI, 1984a).

The direccion of regional groundwater flow in both the upper and lower zones beneath AFP 44 is northwest. The hydraulic gradient for the upper zone is approximately 15 feet per mile or greater (Figure 3-9). Historical water contour maps indicate that the direction of flow and the hydraulic gradient have not changed significantly in the vicinity of AFP 44 since 1952 (HMI, 1982a). The average hydraulic conductivities of the upper and lower zones of the regional aquifer in the vicinity of AFP 44 are estimated to be on the order of 100 to 1,000 gpd/ft^2, and 1 to 10 gpd/ft^2, respectively (HMI, 1982b). The permeability of the lower zone is one to two orders of magnitude less than the permeability of the upper zone, according to area pumping tests. The clay aquitard restricts hydraulic interaction between the upper and lower zones.

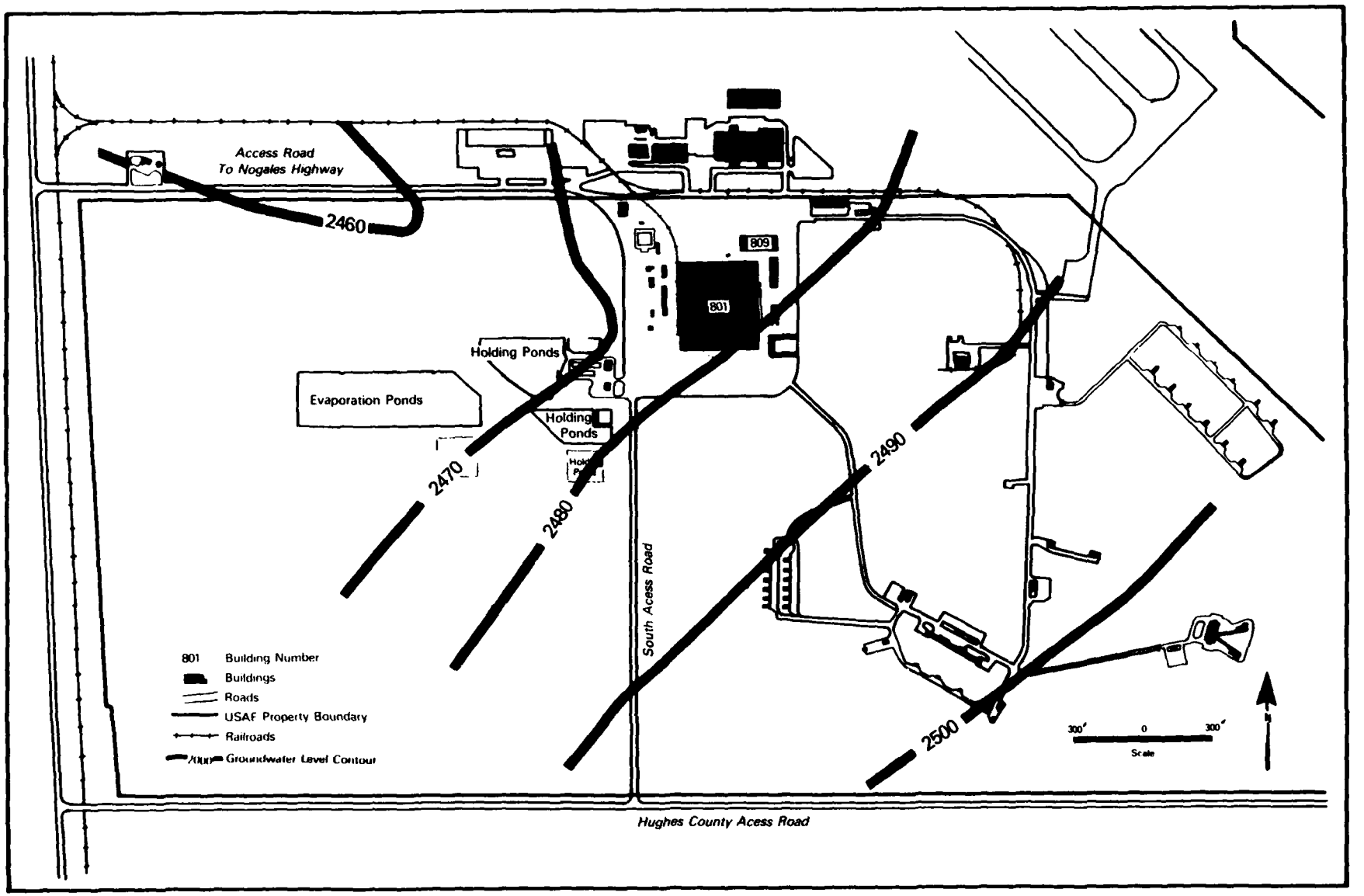
3.8 GROUNDWATER QUALITY

The following sections describe the quality of groundwater in the vicinity of AFP 44.

3.8.1 Geochemistry

The background quality of groundwater in the vicinity of AFP 44 is generally good and chemically suitable for most uses. Historically, the use of groundwater resources in the area has ranged from industrial supply and fire protection, to municipal and domestic drinking water.

Groundwater in the perched zone beneath the plant property is generally a calcium sulfate type, calcium bicarbonate type, or sodium bicarbonate type. Calcium and sodium are the principal cations, and sulfate and bicarbonate are the principal anions in solution. The total dissolved solids content of water samples collected from the perched zone ranges from about 350 to 1,560 milligrams per liter (mg/l), and averages about 800 mg/l. The pH measured during 1983 for perched groundwater beneath AFP 44 ranges from 6.4 to 7.9 (HMI, 1984b).



Source: HMI, 1984b

Figure 3-9. Potentiometric Surface Map of the Upper Aquifer Zone at AFP 44, Tucson, Arizona

Groundwater in the upper zone of the regional aquifer is predominantly a calcium bicarbonate type. The total dissolved solids content of groundwater in the upper zone ranges from about 235 mg/l to 700 mg/l, and averages about 350 mg/l. The pH measured for groundwater in the upper zone from monitoring wells at AFP 44 is normally around 7.0 (HMI, 1984b).

Groundwater in the lower zone of the regional aquifer is a sodium sulfate or sodium bicarbonate type. The total dissolved solids content of lower zone groundwater ranges from about 215 to 385 mg/l. The pH measured for groundwater in the lower zone from monitoring wells at AFP 44 is normally around 7.3 (HMI, 1984b).

3.8.2 Contamination Problems

In December 1979, the Arizona Department of Health Services (ADHS) completed a statewide surface impoundment assessment. As a result of this study, AFP 44 was identified, along with a number of other sites in the Tucson International Airport (TIA) area, as an area requiring further investigation. Early field investigations conducted in the TIA area indicated the presence of a variety of contaminants in wells. In early 1981, an extensive hydrogeologic investigation of subsurface conditions at AFP 44 was initiated to determine whether environmental contamination may have been caused by past hazardous waste handling practices at the facility. A groundwater quality monitoring program comprised of over 100 groundwater monitoring wells has been instituted at and in the vicinity of AFP 44 by the Air Force and Hughes. In addition, other groundwater quality monitoring programs have been instituted in other areas by the EPA, the ADHS, the Arizona Department of Water Resources (ADWR), and the City of Tucson.

The previous investigations, the results of which are discussed in subsequent sections, demonstrated that hazardous waste handling practices employed at AFP 44 prior to the installation of the zero-discharge wastewater treatment plant in 1977 resulted in contamination of groundwater. The continuation of monitoring programs and investigations have also demonstrated that

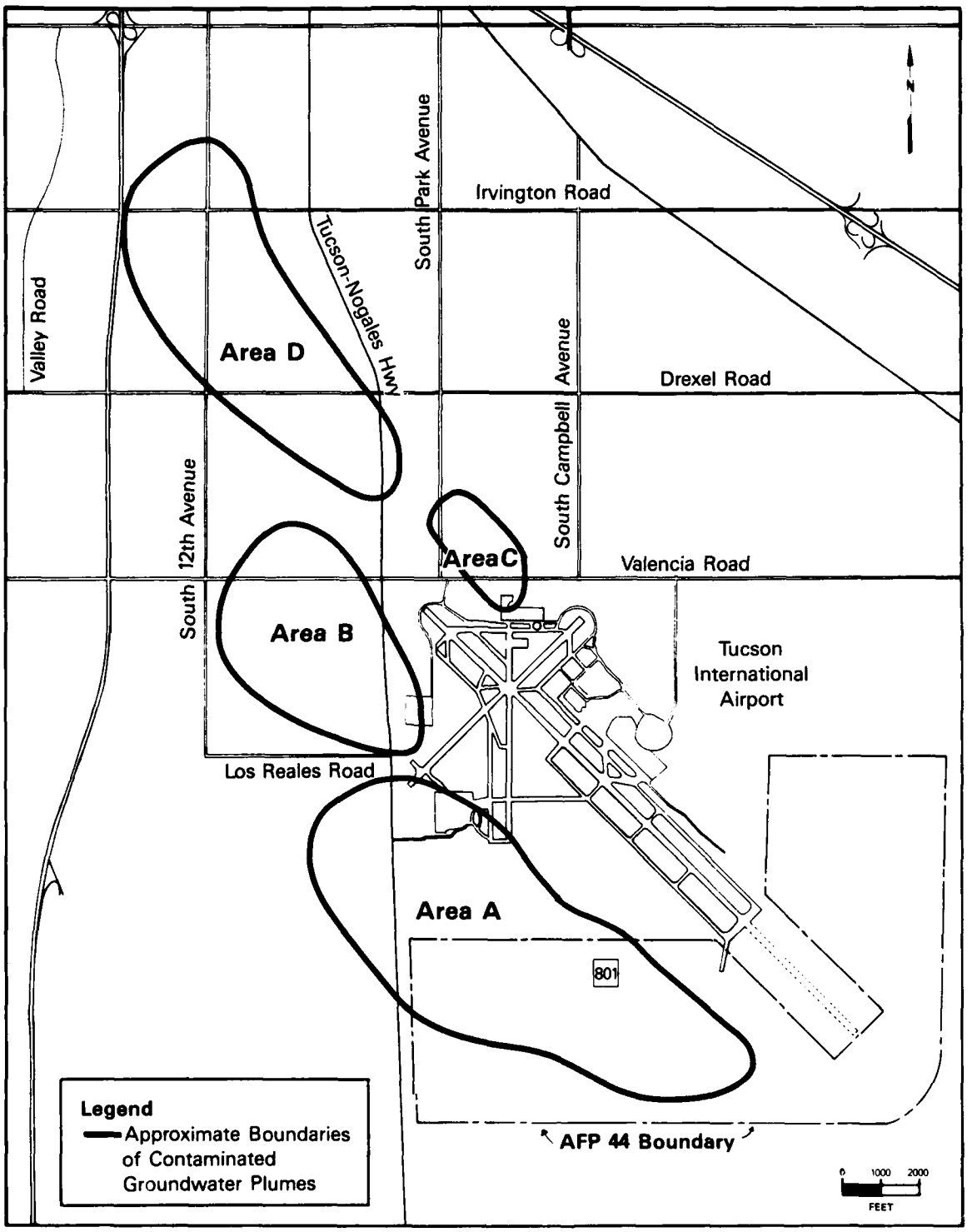
facility operations since 1977 have not caused or contributed to the existing groundwater contamination.

Analyses of groundwater sampling data from the TIA vicinity collected by the USAF, the ADHS, the EPA, the City of Tucson, and the ADWR indicated that four areas of groundwater contamination in the TIA area existed (HMI, 1984a). The configurations of these four areas of contamination based on 1981 and 1982 groundwater sampling data are shown in Figure 3-10. As illustrated in Figure 3-10, the areas of contamination ranged from the AFP 44 vicinity in the south, and along the TIA to the north and northwest for about 3 to 5 miles. The four areas of contamination are suspected to originate from five general source areas consisting of numerous manufacturing companies known to have disposed of industrial wastes in the TIA area (HMI, 1984a). These source areas are discussed in greater detail in Section 3.8.2.6. The area of contamination emanating from AFP 44 presently extends to the vicinity of the Los Reales Road.

Investigations conducted at AFP 44 have resulted in the identification of a number of former disposal sites that could have been sources of that groundwater contamination which emanates from AFP 44. Figure 3-11 illustrates the locations of former disposal sites discussed in the following text. The figure also illustrates the locations of additional former sites to be discussed in Section 4.6.3, Waste Disposal.

The hydrogeologic investigations and groundwater quality studies that have been conducted at AFP 44 to date have provided data that resulted in the following major conclusions:

- High concentrations of TCE and chromium occur within the regional aquifer beneath AFP 44. TCA and DCE levels have generally decreased since monitoring began in 1981 (HMI, 1984b).
- Contaminants in the lower zone of the regional aquifer beneath AFP 44 have not directly migrated from sources at the plant, but appear to have resulted from the mixing of groundwater from the upper and lower zones in two wells that penetrated both zones. These two wells have since been sealed.



Source: HMI, 1983a

Figure 3-10. Approximate Boundaries of the Four Contaminated Groundwater Areas in the Tucson International Airport Area, Based on Data Collected from March 1981 to November 1982

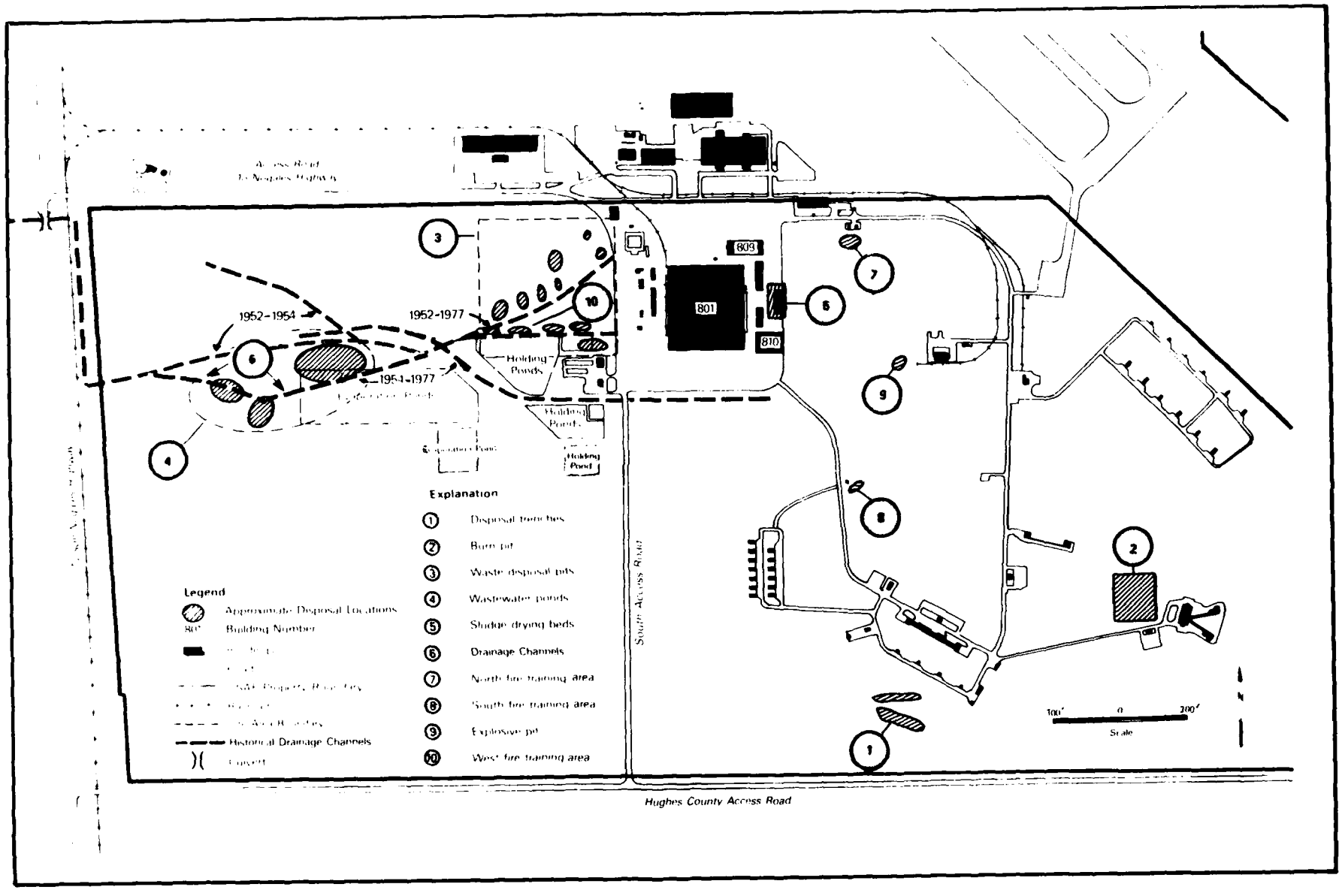


Figure 3-11. Past Disposal Locations at AFP 44, Tucson, Arizona

- Contamination of the regional aquifer immediately north of AFP 44 has probably occurred, in part, as a result of historical waste disposal practices at AFP 44 (HMI, 1984a).

- Contaminated perched groundwater does not pose an immediate threat to water quality in the regional aquifer off-site, and contaminant concentrations have generally decreased since monitoring began in 1981 (HMI, 1982b; HMI, 1984b).

- Former solvent disposal pits located in the area west of Building 801 and north of the wastewater treatment plant (Site 3) were probably the main sources of TCE, TCA, and DCE detected in the regional aquifer beneath the facility (HMI, 1982b).

- Former sludge drying beds east of Building 801 (Site 5) were probably the principal sources of chromium detected in the regional aquifer (HMI, 1982b).

Studies conducted to date are listed below and discussed in the following sections:

- 3.8.2.1, Initial EPA Field Investigation Team (FIT) Project
- 3.8.2.2, Hargis & Montgomery Hydrogeologic Stage I Investigation
- 3.8.2.3, Hargis & Montgomery Hydrogeologic Stage II Investigation
- 3.8.2.4, AFP 44 Digital Simulation of Contaminant Transport
- 3.8.2.5, AFP 44 Hydrologic Monitoring Program
- 3.8.2.6, Tucson Groundwater Contamination Study Task Force Program
- 3.8.2.7, Phase IV Remedial Action Program.

3.8.2.1 Initial EPA Field Investigation Team (FIT) Project

On March 3 and 5, 1981, a series of groundwater samples were collected at eight off-site wells and three on-site wells by FIT members. The well locations close to and on AFP 44 are identified in Figure 3-12.

Concentrations of aluminum were found in all eleven wells, the highest levels were reported for wells SC-7 (700 ppb); HAC 1 (670 ppb), and HAC 4 (11,000 ppb). The other values ranged from 92 to 300 ppb. Five wells (HAC 1, HAC 2, HAC 4, SC-7, and Cobb) showed measurable concentrations of chromium. Wells HAC 1 and HAC 4 showed chromium concentrations at 160 ppb and 53 ppb, respectively, and the reported values for other wells ranged from 12 to

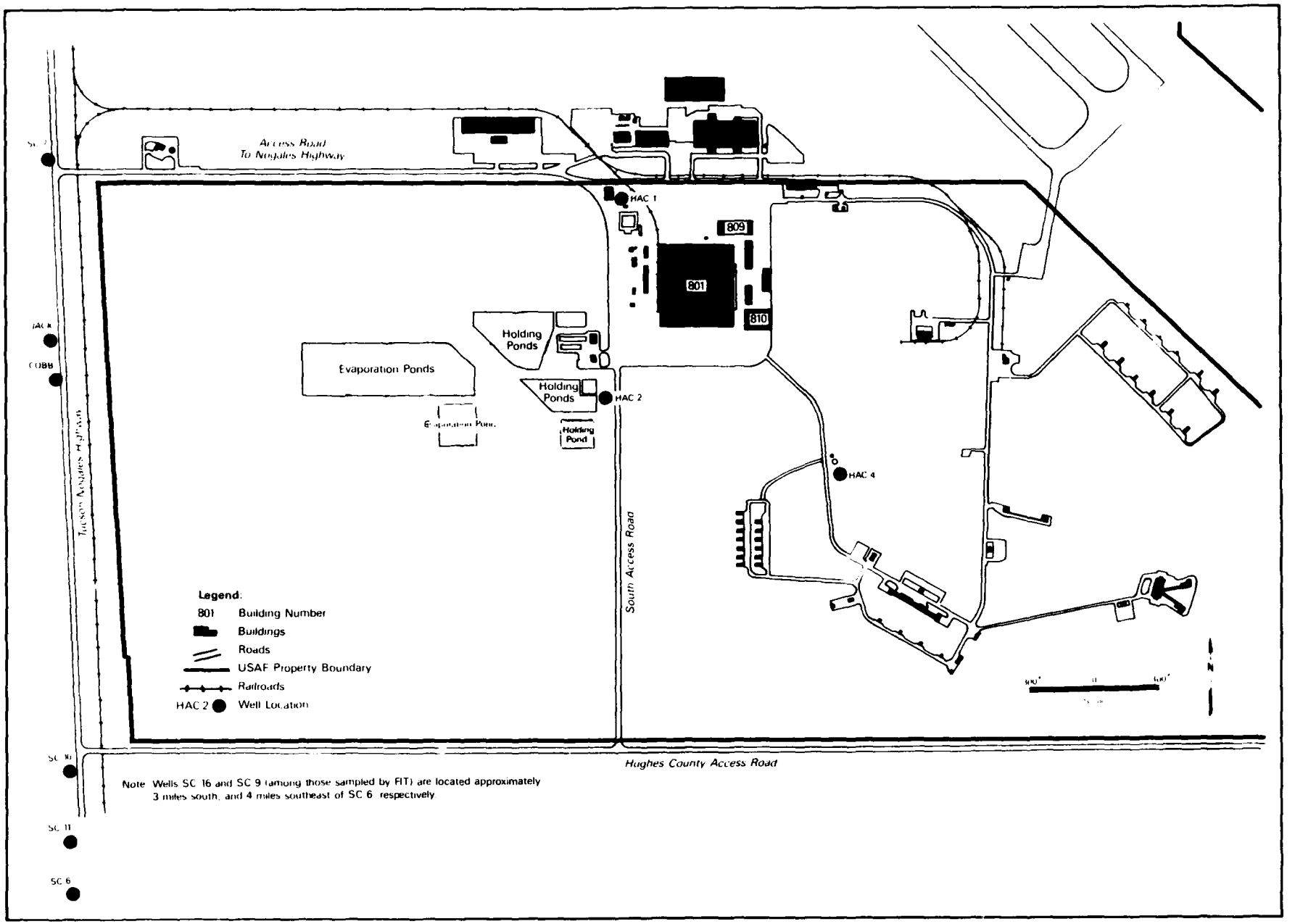


Figure 3-12. Locations of Wells Sampled by the FIT in March 1981, AFP 44, Tucson, Arizona

28 ppb. The USEPA drinking water standard for chromium is 50 ppb. Barium levels were reported for all eleven wells, HAC 4 had the highest concentration at 840 ppb. All other values ranged from 120 to 300 ppb. All reported concentrations were lower than the drinking water standard of 1,000 ppb. Iron levels were also reported for all eleven wells and the highest value reported was for HAC 4 at 15,000 ppb. All other values ranged from 32 to 450 ppb. The desirable limit for iron is 300 ppb. A lead concentration was reported only for HAC 4 at a level of 100 ppb. Manganese was also reported for HAC 4 (730 ppb), Cobb (11 ppb), and HAC 1 (41 ppb). The drinking water standard for both lead and manganese is 50 ppb. Boron concentrations were reported for all of the wells, with concentrations ranging from 81 to 290 ppb, well SC-11 had the highest value.

Cyanide was only reported for wells Jack and Cobb at respective concentrations of 0.011 and 0.010 ppm. The only organics detected in one or more of the eleven wells include TCE, TCA, DCE, and several phthalate esters.

The phthalate esters were only found in the municipal wells SC-10, SC-11, SC-6, SC-16, SC-9, Jack, and Cobb; and were thought to have emanated from vacuum pump lubricating oils or erosion of PVC plastic. The concentrations were not at significant levels (E&E, 1981). TCE was detected in wells SC-7 (77 ppb), HAC 1 (4,600 ppb), and HAC 4 (100 ppb). DCE was detected in wells SC-7 (11 ppb) and HAC 1 (260 ppb). TCA was only detected in well HAC 1 at 120 ppb.

The preliminary data collected during the March 1981 FIT project showed some evidence that groundwater contamination had occurred on-site and that contaminants may be migrating in a north-northwest direction. The conclusions drawn from the results of this investigation included the need for additional sampling and analysis of wells at and around the site, and the need to identify potential contributory off-site sources of contamination. Only in this manner could the March 1981 sampling results be confirmed, and the lateral and vertical extent of contamination be defined.

3.8.2.2 Hargis & Montgomery Hydrogeologic Stage I Investigation

In the spring of 1981, Hargis & Montgomery, Inc. (HMI) was contracted to conduct a preliminary hydrogeologic investigation to determine the impact of historical waste disposal practices on groundwater quality at AFP 44. The locations of the waste disposal sites referenced in the following section were identified on Figure 3-11.

During the months of May and June of 1981, five monitoring wells and 15 soil borings were constructed at AFP 44, as shown in Figure 3-13. Five of the 15 soil borings were completed as monitoring wells in the perched groundwater zone. Soil borings were drilled at those locations identified as waste disposal sites. Soil samples were collected and analyzed to determine the levels of trace metals and organic contaminants. The monitoring wells were installed in both the upper and lower zones of the regional aquifer system, and in the perched groundwater in the vicinity of the former wastewater disposal ponds and sludge drying beds (Sites 4 and 5).

Groundwater samples were collected monthly from wells HAC 1, HAC 3, HAC 4, and the Credit Union (CU) well beginning in May of 1981. Monitoring wells M-1A, M-1B, M-2A, M-2B, and M-2C were sampled monthly after they were installed. The chemical analyses conducted for water samples included routine constituents, selected trace metals, and volatile organics. In addition, selected wells (B-1, HAC 1, and CU) were also sampled for EPA priority pollutants.

The HMI investigation generated a large volume of analytical data which will not be presented in this report. These data are available in the HMI Stage I report referenced in Appendix D. The most critical data and the conclusions that were drawn by the investigation are summarized below (HMI, 1982a):

- TCE, TCA, DCE, toluene, bis (2-ethylhexyl) phthalate, and hexavalent chromium were detected in the perched groundwater zone and suggested that percolation of wastewaters had occurred from the former wastewater holding ponds (Site 4) and a drainage channel (Site 6) located north of the evaporation ponds.

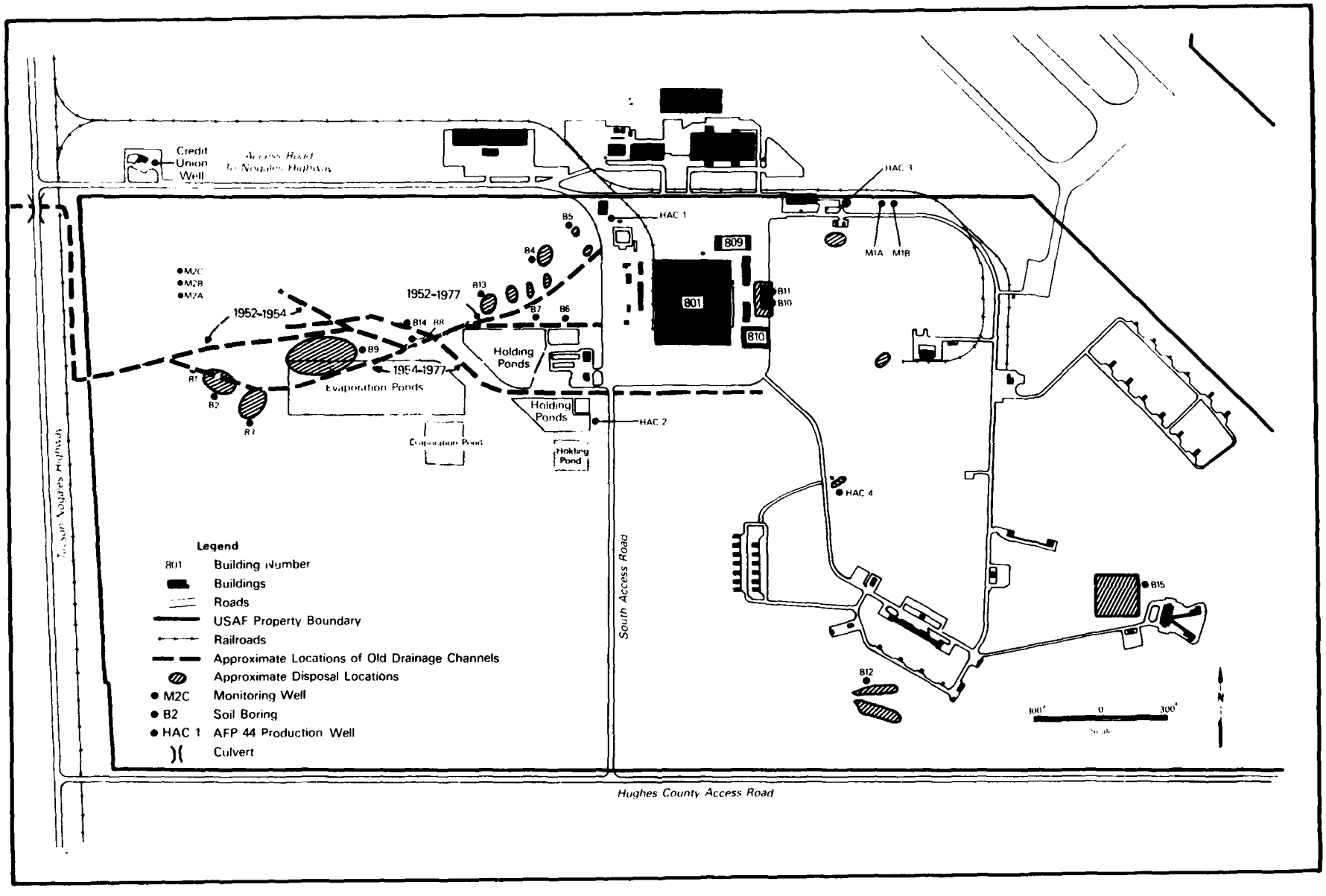


Figure 3-13. Locations of Monitoring Wells and Soil Borings From Stage I of the Hargis & Montgomery Investigation, AFP 44, Tucson, Arizona

- The occurrence of TCE, TCA, DCE, and elevated chromium concentrations in the upper zone of the regional aquifer suggested that infiltration and percolation of wastewaters had occurred, and that wastewater had reached the regional aquifer system.

- The absence of chromium in water samples obtained from monitoring wells screened only in the lower zone of the regional aquifer indicated that migration of chromium to the lower zone had not occurred.

- Based on soil analyses results, which showed elevated levels of trace metals, the former wastewater disposal ponds and sludge drying beds (Sites 4 and 5) were probably the principal disposal sites at AFP 44 for wastewater and sludge containing trace metals. Significant concentrations of trace metals were not reported for soil samples collected in or adjacent to the drainage channel (Site 6).

- TCE concentrations in soils were greatest at suspected sites of former waste disposal (Sites 1, 2, and 3); which suggested that these areas were the principal disposal sites for TCE. Soil analyses results also suggested that TCE was discharged in wastewater to the drainage channel and former wastewater holding ponds (Sites 6 and 4, respectively).

The final HMI Stage I report included recommendations for expanded and continued investigative work at AFP 44. In order to define the distribution of contaminants in the regional aquifer, more information was needed to determine the extent of contaminated groundwater beneath the facility in both the regional and perched zones, and the concentration of contaminants in the aquifer. Additionally, the report recommended further investigation to determine the extent of contribution by on-site contaminants to off-site groundwater contamination (HMI, 1982a).

3.8.2.3 Hargis & Montgomery Hydrogeologic Stage II Investigation

The design of the Stage II investigation was based on data collected during the Stage I investigation discussed above. The Stage II investigation involved drilling additional soil borings at known and suspected disposal sites; soil sample collection and analysis; installation of additional groundwater monitoring wells; and continued groundwater sampling and analysis.

During the Stage II investigative effort during the winter of 1981, 31 additional monitoring wells were completed at AFP 44 as shown in Figure 3-14. Eleven of these were completed in the perched groundwater and 20 were

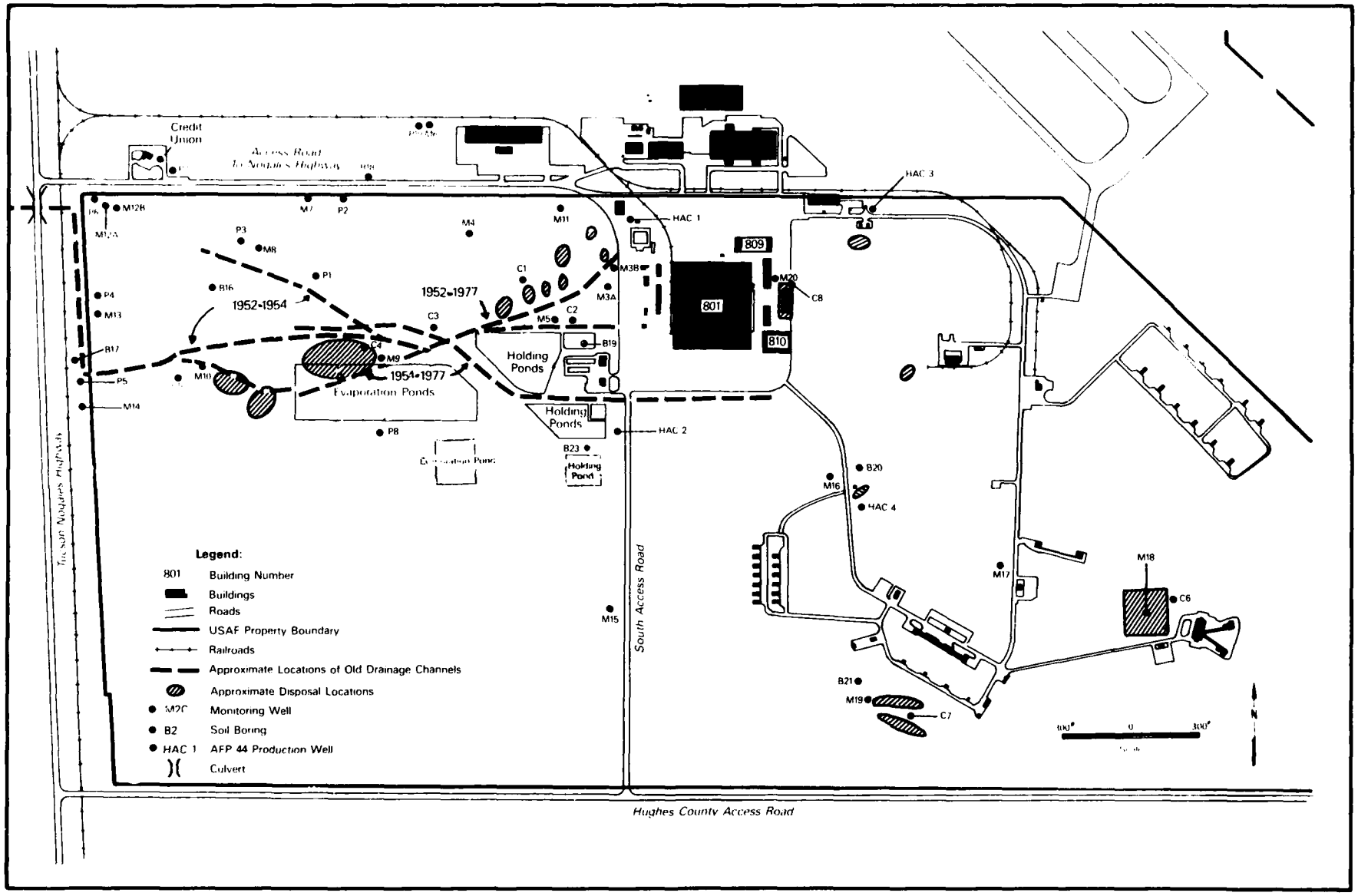


Figure 3-14. Locations of Monitoring Wells and Soil Borings From Stage II of the Hargis & Montgomery Investigation, AFP 44, Tucson, Arizona.

completed in the upper and lower zones of the regional aquifer. In total, during both the Stage I and Stage II investigations, 41 monitoring wells were installed; 17 were completed to monitor the perched groundwater, and 24 were completed in the regional aquifer.

Significant concentrations of chromium, iron, manganese, and zinc were detected in groundwater samples obtained from the perched zone. Concentrations of trace metals in samples obtained from borings B-1, B-2, B-3, and B-9 near the former wastewater disposal ponds and sludge drying beds (Sites 4 and 5) were as high as 0.16 ppm for chromium, 0.13 ppm for iron, 1.10 ppm for manganese, and 1.80 ppm for zinc. Consequently, concentrations of chromium and manganese in the perched groundwater exceeded the EPA's established limit (0.05 ppm) for drinking water.

TCE and DCE were detected in all perched zone monitoring wells except wells P-6 and P-10. TCE concentrations ranged from none detected to more than 1,600 ppb and were highest in P-1, B-1, B-2, B-3, and B-9; which were constructed in the area of the former wastewater disposal ponds.

TCA concentrations detected in the perched groundwater ranged from none detected to 390 ppb, the highest level was found in B-7 located north of existing holding ponds along the drainage channel (Site 6).

Maximum concentrations of DCE in the perched zone ranged from none detected to 690 ppb. The highest DCE level was found in B-3 near the former disposal ponds (Site 4). Wells B-1, B-2, and B-9, which are also located in the disposal pond areas (Site 4), showed levels between 390 and 480 ppb.

Chromium, zinc, manganese, and arsenic were detected in groundwater obtained from monitoring wells penetrating the regional aquifer at AFP 44. Chromium was the only trace metal detected at a level that exceeded EPA's drinking water standard of 0.05 ppm. The highest chromium concentrations in the upper zone occurred in the area between well M-20, which is located near the two former sludge drying beds east of Building 801 (Site 5), and well HAC 1. Another area found with high chromium levels in groundwater in the

upper aquifer zone was between wells M-7 and CU. Groundwater samples obtained from the lower aquifer zone had chromium levels less than 0.01 ppm.

TCE was detected in all groundwater monitoring wells in the upper zone of the regional aquifer, except for wells M-1A and M-15. TCE was also found in samples taken from M-3B and M-12B which penetrate the lower zone. TCE levels in the upper zone ranged from 13,000 ppb at M-11 to 3 ppb at M-19. Concentrations of TCE in the lower zone were 86 ppb in M-3B and 2 ppb in M-12B.

TCA was only detected in monitoring wells in the area west of well HAC 1 and north of existing evaporation and holding ponds. TCA levels in this area ranged from 1 to 630 ppb. The highest concentration occurred in M-11, approximately coincident with the area of highest TCE concentrations. TCA was not detected in the lower aquifer zone.

DCE was detected in wells located in the area west of M-20 and north of existing evaporation and holding ponds. Concentrations in the upper zone ranged from none detected to 3,320 ppb. The highest DCE concentration in the upper zone occurred in the vicinity of M-5 and also appeared to be coincident with areas of highest TCE and TCA levels. DCE was detected only in the lower zone at well M-3B. Specific information regarding the Stage II chemical analytical data is available in the HMI Stage II report referenced in Appendix D.

The distribution and concentrations of TCE, TCA, and DCE in the upper zone of the regional aquifer suggested that the principal area of former waste disposal for substances containing these organic compounds was located in the area west of Building 801 and north of existing evaporation and holding ponds (Site 3). The data also indicated a former disposal site in the southeastern portion of AFP 44 property in the vicinity of M-18 (Site 2).

The TCE and DCE concentrations and distribution in the lower aquifer zone suggested that contamination of the lower zone occurred only in the area west of Building 801 and north of the holding ponds (Sites 4 and 3). The concentration and distribution of chromium in the upper aquifer zone suggested that

the principal source of chromium contamination was seepage from the former sludge drying beds located east of Building 801 (Site 5).

In conclusion, the results of the Stage II investigation supported the Stage I findings and were used to determine which areas on-site were contaminant sources.

3.8.2.4 AFP 44 Digital Simulation of Contaminant Transport

A solute transport model was compiled and calibrated for the regional aquifer in the area of AFP 44 based on results of the Stage I and Stage II investigations of subsurface conditions. The following section briefly discusses the application of the model and the conclusions drawn from the model results. A detailed discussion of this model and its use is available in Hargis & Montgomery's October 1982 interim report entitled: "Digital Simulation of Contaminant Transport in the Regional Aquifer System, U.S. Air Force Plant No. 44, Tucson, Arizona" (HMI, 1982c).

The purpose of the groundwater flow and solute transport model was to develop a tool to simulate the transport of contaminants in the groundwater flow system in the vicinity of AFP 44. The model has been used to simulate the transport of the volatile organic compound TCE in the groundwater flow system.

The model area comprised approximately 55 square miles in the west-central portion of the Tucson Basin and included several areas of known groundwater contamination and suspected off-site contaminant sources. However, only contaminant sources presumed to originate from AFP 44 were included in this particular model study. The results of the model simulation provided evidence of off-site sources of groundwater contamination in the TIA area.

A suitable digital model was selected and calibrated to simulate groundwater conditions for the period 1952 to 1982. The selected model was developed by the U.S. Geological Survey for specific application to aquifer contamination problems (HMI, 1982c). The model includes advection of solute

mass at the mean velocity of flowing groundwater and the spreading of solute mass caused by dispersion. The model is two-dimensional, so that the concentrations of solute at a given location represent an average over the vertical thickness of the aquifer. Only horizontal changes in contaminant concentrations were considered.

Calibration of the model and simulation of the development of a contamination plume required that data be compiled which characterized the regional aquifer, the hydraulic stresses imposed on the aquifer, and the contaminant inputs. The location of contaminant sources and periods of contaminant input were estimated based on information concerning historical waste disposal practices and contaminant concentrations in the groundwater. This data was gathered during the Stage I and Stage II investigations (HMI, 1982a; HMI, 1982b).

Computed TCE concentrations in the upper aquifer zone beneath AFP 44 generally duplicated the measured concentrations. Simulations were best in the areas west and southwest of Building 801, where concentrations have been measured at a relatively large number of locations. At that time, concentrations were not as well known south and southeast of Building 801, and only the general features indicated by the data in this area were reproduced.

The effects on the regional aquifer of TCE contamination at AFP 44 were estimated by simulating known groundwater conditions and imposing contaminant sources. The results for 1982 data provided a framework for evaluating the contribution of historical waste disposal practices at the plant to the degradation of water quality northwest of the plant. Results of the 1982 computer model simulation indicated that the area of contaminated groundwater originating from the plant, as measured by a 10 ppb contour of TCE concentration, probably did not extend north of Los Reales Road (HMI, 1982c).

Samples collected in September 1984 from eleven monitoring wells installed beyond what was believed to be the boundary of the area of contamination confirmed the computer model projection of the extent of contaminant transport in the regional aquifer. However, these recent results, when

interpreted together with the computer model projections, also suggested the possibility that the low concentrations of TCE at the northernmost limits of the plume emanating from AFP 44 may have intermingled with another plume containing higher volatile organic compound concentrations from sources other than AFP 44. These other sources would be in the TIA area south of Los Reales Road.

In order to refine estimates of the extent of contamination in the area north of AFP 44, the Hargis & Montgomery interim report recommended that the model be maintained and updated continuously with current data collected from new monitoring wells constructed in areas north and northwest of AFP 44 (HMI, 1982c).

3.8.2.5 AFP 44 Hydrologic Monitoring Program

As described in the previous sections, a long-term hydrologic monitoring program was initiated at AFP 44 with the Stage I investigation in May 1981. The purpose of the long-term groundwater quality monitoring program was to provide adequate data to accomplish the following objectives (HMI, 1984b):

- Define the nature and extent of contamination in the regional and perched aquifers that has resulted from waste handling practices at AFP 44 prior to 1977
- Estimate the extent and concentration of contaminants in the regional aquifer northwest of AFP 44 by utilizing a solute transport model
- Design a system for removing contaminants from the area of groundwater contamination emanating from AFP 44.

The monitoring program began with the collection of groundwater samples from 10 borings and monitoring wells installed during the Stage I investigation, and from four existing wells at the plant. During the Stage II investigation, the monitoring program was expanded to include 24 aquifer monitoring wells (20 upper zone wells; 4 lower zone wells) and 17 soil borings and wells completed as perched zone monitoring wells. Ten additional monitoring wells were installed at AFP 44 in June and July of 1983 to further define the hydrogeologic conditions and distribution of contaminants in the

regional aquifer beneath the facility. Six of these wells were completed in the upper aquifer zone and four wells were completed in the lower zone of the regional aquifer. These additional wells are shown on Figure 3-15. Samples collected and analyzed from these wells have been used to define the extent of contamination in groundwater beneath the plant, and permit the continued monitoring of groundwater levels and groundwater quality in the plant vicinity (HMI, 1984b).

Two summary reports have been completed to date that discuss the results of the groundwater quality monitoring program at AFP 44 (HMI, 1983; HMI, 1984b). The conclusions drawn from the results of the more recent of these two reports, which summarizes monitoring and sampling conducted during 1983, are discussed in the following paragraphs.

Perched Zone

Groundwater samples collected from perched zone monitoring wells indicated concentrations of chromium ($\leq$0.14 ppm) and lead ($\leq$0.84 ppm) that exceed primary drinking water standards, which is 0.05 ppm for both constituents. In general, trace metal concentrations in this groundwater zone have remained constant since monitoring began late in 1981.

The concentrations of the volatile organic compounds (VOC) TCE, TCA, and DCE in the perched zone beneath the plant have generally decreased since monitoring began in 1981, although a few perched zone wells experienced small increases in VOC concentrations at different times during 1983. Perched groundwater downgradient of the former unlined ponds (Site 4) generally had TCE concentrations less than 50 ppb during 1983. The higher TCE concentrations were found in the area underlying and north of the former unlined ponds. The maximum TCE levels found in these areas ranged from 120 ppb to 1,400 ppb. TCA and DCE concentrations were also highest in the area of the former unlined ponds ranging from 74 ppb to 160 ppb and 120 ppb to 230 ppb, respectively. TCA and DCE levels downgradient of this area were generally less than 50 ppb.

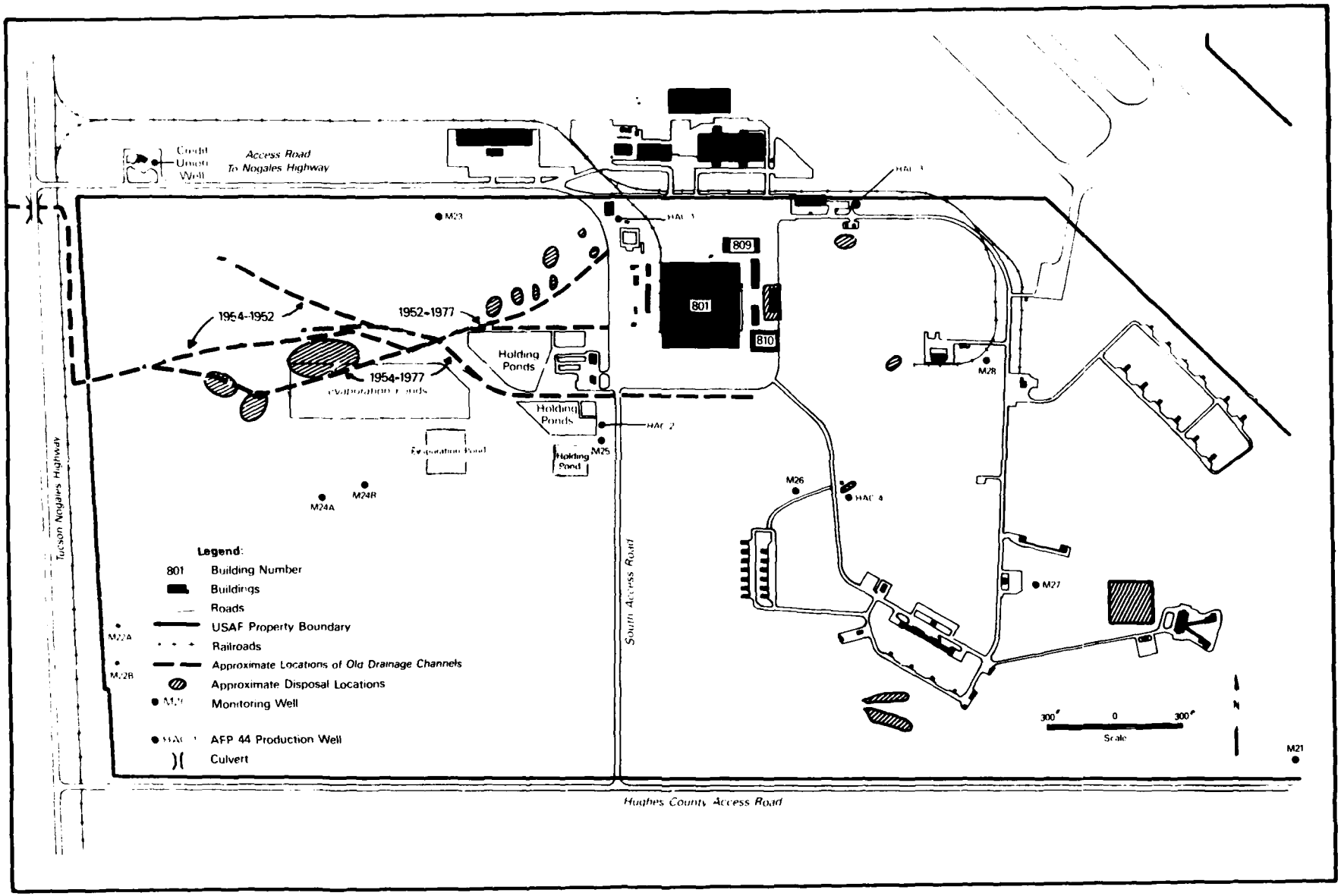


Figure 3-15. Locations of Ten Additional Monitoring Wells Installed in 1983 at AFP 44, Tucson, Arizona.

Upper Zone

Concentrations of routine constituents and trace metals in groundwater samples collected from the upper zone of the regional aquifer were generally unchanged since monitoring began in 1981. Chromium remains the only trace metal detected in concentrations exceeding the primary drinking water standard. Chromium concentrations in the upper zone ranged between 0.01 and 0.43 ppm. The primary drinking water standard for chromium is 0.05 ppm. Of the remaining trace metals detected (Cd, Cu, Fe, Mg, Hg, Zn), concentrations did not exceed the secondary drinking water standards.

The historical pumping of plant production wells HAC 1 and HAC 3 was initially responsible for localizing high TCE, TCA, and DCE concentrations within a small area beneath the facility. When pumping from these wells was discontinued, HAC 1 in 1979 and HAC 3 in 1981, water levels recovered and the downgradient transport of contaminants was no longer impeded. A comparison of 1982 and 1983 sampling results for the volatile organic compounds TCE, TCA, and DCE in the upper zone indicated a decrease in concentrations in the groundwater underlying the former disposal areas west of Building 801, and increases in concentrations downgradient of these former disposal areas.

The concentrations of TCE detected in groundwater immediately west of Building 801 and north of the old holding ponds have decreased by as much as 15,000 ppb since monitoring began in late 1981. Wells located downgradient of the former unlined ponds, in the vicinity of the Credit Union well, exhibited increases in TCE concentrations by as much as 3,100 ppb.

Both TCA and DCE concentrations in the upper groundwater zone exhibited the same trends as the TCE levels. Decreases in both of these contaminant levels occurred in the vicinity of the former disposal areas, and areas of increased concentrations were coincident with areas of high TCE levels downgradient of the old disposal areas.

Lower Zone

Groundwater samples collected from eight monitoring wells constructed in the lower zone of the regional aquifer did not indicate a change in trace metal concentration in the lower zone since monitoring began in 1981. Chromium was the only trace metal detected at a concentration ($\leq$0.11 ppm) that exceeded the primary drinking water standard (0.05 ppm).

The lower zone does not appear to have been directly contaminated by past disposal practices at AFP 44. Concentrations of TCE, TCA, and DCE in the lower zone may be the result of cross-contamination between aquifers through wells (HAC 1, SC-7, HAC 4) open to both the upper and lower aquifer zones. These wells were probat conduits for downward movement of contaminated groundwater from the upper to the lower zone. Three wells on AFP 44 have since been sealed to prevent the recurrence of this process.

TCE concentrations in groundwater in the lower zone in the vicinity of well HAC 1, which penetrated both zones, ranged between 220 ppb and 240 ppb during 1983. This was an increase from 1981 and 1982 sampling results of 22 ppb and 56 ppb, respectively. Groundwater in the vicinity of well SC-7 (a closed city well which penetrates both zones) indicated a decrease in TCE levels from 8 ppb to 4.1 ppb from 1981 to 1983.

TCE was not detected in the lower zone near well HAC 4 during 1983. TCA was also not detected in groundwater samples from lower zone monitoring wells during 1983. In 1982, TCA levels in lower zone water samples near wells HAC 1 and SC-7 were less than 10 ppb. Finally, DCE was detected near well HAC 1 during 1981 at a concentration of less than 15 ppb, and was not detected in a water sample collected in 1983.

A more detailed discussion of the contaminant levels and their changing trends in the different groundwater zones at AFP 44 is available in Hargis & Montgomery's June 1984 report entitled: "Summary of 1983 Hydrologic Monitoring Program, AFP 44, Tucson, Arizona."

3.8.2.6 Tucson Groundwater Contamination Study Task Force Program

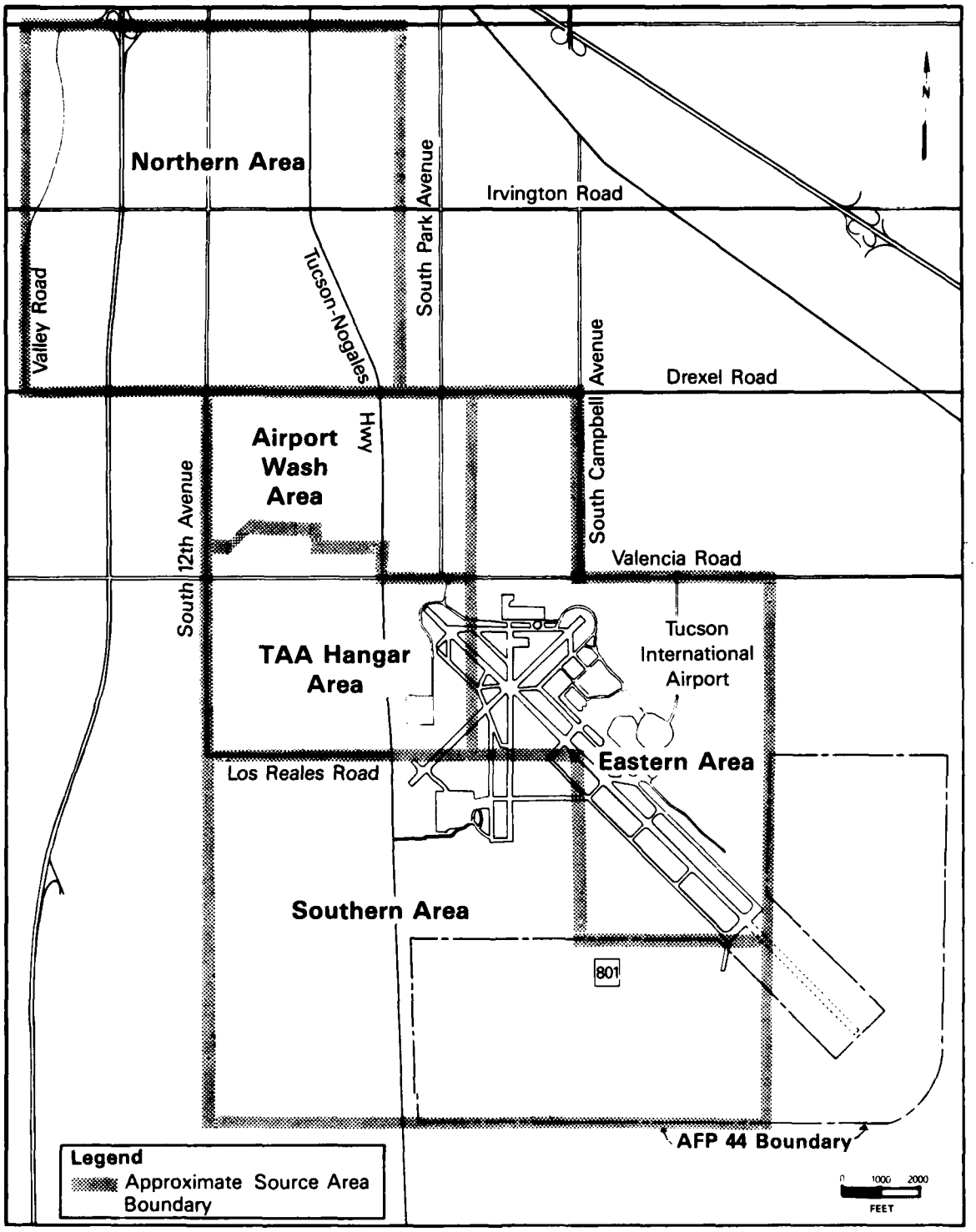
The Tucson Groundwater Contamination Study Task Force was formed in 1981 to investigate the occurrence of contaminants in the groundwater in the vicinity of Tucson International Airport (TIA) and formulate recommendations for aquifer restoration. The Task Force consists of representatives from the U.S. Environmental Protection Agency (EPA), Arizona Department of Health Services (ADHS), Arizona Department of Water Resources (ADWR), the City of Tucson Water Department (TWD), and the Pima County Health Department (PCHD). The purpose of the investigation was to define the extent of groundwater contamination in the TIA area, and identify the potential sources of groundwater contamination associated with waste disposal practices and other industrial activities in the airport vicinity.

Activities completed by the Task Force were as follows:

- Construction/sampling of soil borings
- Water sample analysis from private and municipal wells in the TIA area
- Hydrogeologic analysis
- Water sample analysis from eleven monitoring wells in the TIA area
- Delineation of suspected contaminant source areas in the TIA area.

Eleven monitoring wells had been constructed by EPA as part of the Task Force study. These wells were installed to aid in determining the off-site extent of groundwater contamination in the TIA area north of AFP 44, and to assess hydrologic conditions in the airport area. Analysis of water quality data collected from the eleven EPA wells and a review of reports compiled by the Task Force indicated the following (HMI, 1984a):

- Five general contamination source areas were tentatively delineated by the ADHS (Figure 3-16) and included: (1) the southern area, which included the Tucson Airport Authority (TAA) landfill, an old fire-drill training area, a former dump at the southern end of airport runway No. 3, possible sources related to Gates Learjet Corp. and Newberry Energy Corp., and past disposal areas at AFP 44; (2) the TAA



Source: HMI, 1984a

Figure 3-16. Potential Contaminant Source Areas in the Tucson International Airport Vicinity

hangar area, which included the abandoned Tucson Aviation Center (TAC) disposal pond, drainage channels, and other possible disposal areas used by TAC tenants; (3) the airport wash area; (4) the northern area, which included possible source locations related to the IBM Corporation, Lambda Electronics, and Polypore, Inc.; and (5) the eastern area, which included the Airport fire-drill training area, and possible source locations related to General Electric, Burr Brown, IBM, and the Arizona Air National Guard.

- The chemical residue most widespread in groundwater in the TIA area was the volatile organic compound trichloroethylene (TCE). Four areas of TCE contamination were delineated based on laboratory analyses of groundwater samples (Figure 3-10). The occurrence of TCE in groundwater in each of these areas may be related to one or more of the five potential contaminant source areas identified in Figure 3-16.

- Data collected by the Tucson Groundwater Contamination Study Task Force confirmed that there were other areas of groundwater contamination in the TIA area distinct from the area of contamination emanating from AFP 44.

The Task Force study is ongoing, and includes periodic sampling of wells in the TIA area and the planned construction of additional monitoring wells north of AFP 44. Groundwater samples have been collected from wells throughout the TIA area by the various agencies involved in the Task Force study. Sample collection began in March 1981 when the EPA FIT sampled eleven wells in the vicinity of TIA. Additional well sampling in the area was conducted by the EPA FIT in May 1981 during a follow-up investigation. In October 1981, the ADHS and TWD conducted a joint sampling program which included testing and sampling of TWD wells and distribution systems. In July 1982, PCHD began sampling domestic wells in the TIA vicinity. This program was completed in October 1982.

3.8.2.7 Phase IV Remedial Action Program

The previous investigations conducted at and in the vicinity of AFP 44 demonstrated that hazardous waste handling practices employed at the facility prior to the commencement of operations at the zero-discharge industrial wastewater treatment plant in 1977 resulted in an area of contaminated groundwater emanating from AFP 44. In light of this evidence, a remedial action plan consisting of numerous alternatives (i.e., similar in scope to the

USEPA's Remedial Investigation/Feasibility Study Program) has been developed by the Air Force to mitigate migration of contaminants from AFP 44. The final draft of the remedial action plan was published for public comment on October 4, 1985.

3.9 BIOTIC ENVIRONMENT

The land area within a five-mile radius of AFP 44 is, in part, occupied by native plant and animal communities. Much of the vegetational habitat within this area, particularly to the northwest, west, and southwest of the facility, is classified as Sonoran Desert scrub, although some variety is provided by desert washes and the Santa Cruz River.

Plant communities generally consist of cacti, shrubs, and small trees. The most abundant cacti in the immediate vicinity are the prickly pear, several chollas, and the barrel cactus. Shrubs in the area include creosotebush, desert broom, burroweed (bursage), ocotillo, and brittlebush. Small trees that are present include foothills paloverde, blue paloverde, mesquite, cat-claw, acacia, and iron wood.

There is abundant animal life away from the vicinity of the airport. Numerous bird species, squirrels, jackrabbits, and desert rabbits are present in the area. Within an approximate 50-mile radius of the plant, there are a large number of plants and animals listed, or that may be soon listed, as threatened or endangered species. These plants and animals are identified in Table 3-3. However, there is no evidence indicating the presence of threatened or endangered species on plant property.

3.10 ENVIRONMENTAL SUMMARY

The following summarizes the major environmental characteristics in the vicinity of AFP 44:

- The regional aquifer system that exists in the vicinity of AFP 44 is comprised of an upper and lower zone. These two zones are separated by a thick sequence of clayey sediments, which restricts hydraulic interaction between the two zones.

Table 3-3. RARE PLANT AND ANIMAL SPECIES RESIDING ON OR TRANSIENT WITHIN AN APPROXIMATE 50-MILE RADIUS OF AIR FORCE PLANT 44, TUCSON, ARIZONA

Common Name	Scientific Name	Status[a] Federal	State	Habitat
ANIMALS				
Jaguarundi	Felis yagouroundi	E		Brushy areas, thorn thickets
Beardless Flycatcher	Camptostoma imberbe		T	Dense thickets
Black-Bellied Whistling Duck	Dendrocygna autumnalis		T	Occasional migrant
Masked Bobwhite	Colinus virginianus ridgwayi	E	E	Brushy areas
Mexican Duck	Anas diazi	E		Occasional migrant
Peregrine Falcon	Falco peregrinus	E		Occasional migrant
Southern Bald Eagle	Haliaeetus leucocephalus	E		Occasional migrant
Zoned-Tailed Hawk	Buteo albonatus		T	Occasional migrant
Gila Topminnow	Poeciliopsi occidentalis	E	T	Streams
Desert Tortoise	Gopherus agassizi		T	Sonoran desert scrub
Gila Monster	Heloderma suspectum		T	Sonoran desert scrub
PLANTS				
Arizona Manihot	Manihot davisiae	C1		Rocky slopes
Beardless Chinchweed	Pectis imberbis	C1		Oak woodlands
Five Scale Bitterweed	Hymenoxys quinquesquamata	C2		
Goodding Onion	Allium gooddingii	C1		Riparian
Lemmon Cloak Fern	Notholaena lemmoni	C2		
Needles Knotweed	Polygonum fusiforme	C2		Riparian
Needle Spine Pineapple Cactus	Neolloydia erectocentra	C1		Sonoran desert scrub
Nichol Turks Head Cactus	Echinocactus horizonthalonius var. nicholli	E		Sonoran desert scrub
Night-Blooming Cereus	Peniocereus greggii	C2		Sonoran desert scrub
Pringle Lip Fern	Cheilanthes pringlei	C2		
Santa Catalina Beardtongue	Penstemon discolor	C1		Granite cliffs
Stout Needle Muhly	Coryphantha scheeri var. robustispina	C1		Rocky slopes
Thornber Fishook Cactus	Mammilaria thornberi	C1		Sonoran desertscrub
Thurber Tithonia	Tithonia thurberi	C2		
Tumamoc Globeberry	Tumamola macdougalii	C1		Desert washes

Source: CH2M Hill, 1982

[a] E--"Endangered"
T--"Threatened"
C1--"Category 1"--Appropriate for listing.
C2--"Category 2"--Appropriate for listing, but additional information required.

- A sandy clay layer also occurs above the regional aquifer in the vicinity of AFP 44. The layer acts as an aquitard and retards the downward movement of fluids. The aquitard has caused the development of a perched groundwater zone beneath plant property in the vicinity of the former holding and evaporation ponds. Contaminants from the former ponds have been found in the perched zone.

- The regional water table beneath AFP 44 occurs at depths from 100 to 140 feet bls.

- Regional groundwater flows in a northwest direction.

- The regional aquifer underlying the City of Tucson is a sole source aquifer in the Tucson area.

- Concentrations of the organic solvents TCE, TCA, and DCE occur in the regional aquifer beneath AFP 44.

- Concentrations of hexavalent chromium (0.2-0.5 ppm) occur in the regional aquifer beneath AFP 44 in two small, restricted areas.

- Five general contaminant source areas were tentatively delineated in the TIA area by the ADHS and were believed to be contributing to the overall groundwater problem in the area. One of the source areas was identified as including the former industrial waste disposal sites at AFP 44.

- Four areas of contamination emanated in a northwesterly direction from the five general contaminant source areas.

- The area of contamination emanating from AFP 44 probably has migrated to the vicinity of Los Reales Road.

- Contamination in the regional aquifer emanating from the TIA area has resulted in the closing of seven City of Tucson water supply wells and two HAC/AFP 44 water supply wells. One of the city wells and both AFP 44 production wells were closed in a response to the discovery of groundwater contamination at AFP 44.

- Surface water drainage is controlled by two intermittent streams, several drainage channels, and the plant's storm drain system. The ultimate discharge of surface water is into the Santa Cruz River.

- The soils within the plant area are generally well-drained and moderately permeable, originating from the alluvial sediments of the Tucson Basin.

- The AFP 44 area has an annual net precipitation rate of minus 55 inches, which provides a low driving force for contaminant migration.

4.0 FINDINGS

The past and current management practices of hazardous materials and wastes at AFP 44 have been investigated and are described in this section. The following information sources were used in developing the section:

- The site visit to AFP 44 on November 12 through 16, 1984
- The review of available plant records, consultant reports, and site plans
- Interviews with employees of Hughes Aircraft Company
- Air Force Facilities contract records
- The review of available records from Federal and state agencies
- Interviews with employees of state agencies.

A list of all sources used can be found in Appendix B, List of Interviewees and Outside Agency Contacts, and Appendix D, References. Information presented in this section was obtained from personal interviews with personnel employed by Hughes unless otherwise referenced.

This investigation focused on the hazardous material and waste management activities relevant only to AFP 44. Activities of interest included the following:

- Industrial shops
- Bulk material storage
- Pest and vegetation control
- Fire training
- Waste management practices.

This investigation only included activities on APF 44 property that is or was owned by the U.S. Government.

Hazardous wastes have been generated at AFP 44 since operations began. On-site treatment and disposal of hazardous wastes has occurred in the past on U.S. Government-owned property. On-site disposal no longer occurs, however, AFP 44 does currently generate, store, and treat hazardous wastes. AFP 44 is authorized by the State of Arizona to store and treat hazardous waste generated at the facility (JRB, 1983). The plant's RCRA Part B permit application for storage and treatment is currently (October 1985) being reviewed by the U.S. Environmental Protection Agency (Region IX). In the meantime, the facility operates under the interim status standards of the State of Arizona.

Sections 4.1 through 4.6 describe current and past hazardous material activities. Section 4.7 evaluates relevant activities based on the Air Force's Hazard Assessment Rating Methodology (HARM).

4.1 INDUSTRIAL SHOPS

From 1951 to the present, activities at AFP 44 have been in support of missile system and component research, development, and testing. Support operations have included equipment cleanup, general maintenance, and engine test firing.

Typical wastes generated from these activities have included waste coolants, solvents, caustics, acids, rinse and cooling waters, paint sludges, plating baths and sludges, and scrap and salvage materials. Wastes have been variably managed by the following methods: treated on-site and reused as process waters, disposed untreated on-site, treated and disposed on-site, and transported off-site for disposal or recovery.

Table 4-1 summarizes the history of industrial waste management activities at AFP 44 since 1952. The table includes a listing of the types of hazardous wastes generated at the various shops and the historical management methods. Table 4-2 presents the current waste generation rates obtained from annual generator reports submitted by Hughes to the Arizona Department of

Table 4-1. Industrial Operations (Shops) Waste Management

Industrial Shop	Locations	Waste Materials	Waste Management Methods[1]
			1952 1955 1966 1977 1984
Machine Shops	801 and 816	Waste Machining Coolant	ON DISP (1952–1966); TNK STOR and OFF DISP (1966–)
		Waste Machining Lubricants	ON DISP (1952–1966); TNK STOR and OFF DISP/RECL (1966–)
		Spent Solvents, Not Otherwise Specified (N.O.S.)	ON DISP (1952–1966); ON DISP or OFF DISP/RECL (1966–1976); DRM STOR and OFF DISP/RECL (1976–)
Assembly Shops	801	Spent Solvents, N.O.S.	ON DISP (1952–1966); ON DISP or OFF DISP/RECL (1966–1976); DRUM STOR and OFF DISP/RECL (1976–)
		Spent 1,1,1-Trichloroethane	ON DISP (1952–1966); TNK STOR, and OFF DISP/RECL (1966–)
		Spent Trichloroethylene	ON DISP (1952–1966); DRM STOR and OFF DISP/RECL (1966–1972, 1982)

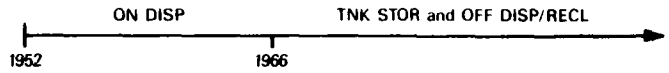
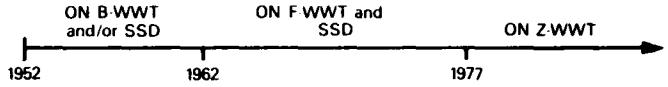
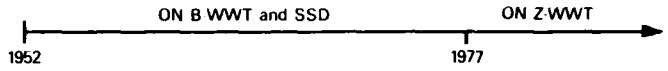
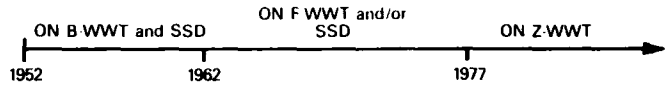
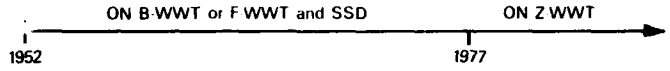
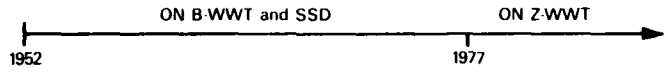
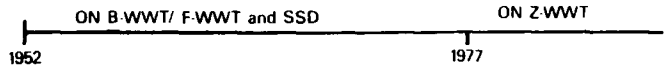
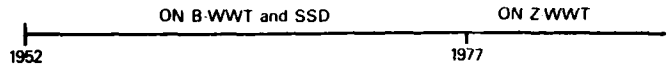
Sources: HAC, 1984; E&E, 1981; HAC, July 1957; HAC, 1958; and Wilson, 1973.

[1] *A dotted line indicates that sufficient information was not available to confirm when the waste generation and/or management practice began and ceased.*

Key to Waste Management Abbreviations:

ON	On Site	STOR	Storage	B-WWT	Batch Wastewater Treatment	TNK	Tank
OFF	Off Site	RECL	Reclamation	F-WWT	Flow-Through Wastewater Treatment	DRM	Drum
DISP	Disposal	SSD	Storm Sewer Discharge	Z-WWT	Zero-Discharge Wastewater Treatment		

Table 4-1. Industrial Operations (Shops) Waste Management (continued)

Industrial Shop	Locations	Waste Materials	Waste Management Methods[1]
Spot Welding Shop and Maintenance Welding Shop	801 and 830	Spent 1,1,1-Trichloroethane	
		Trichloroethylene	
		Caustics and Rinse Waters	
		Waste Acid Solutions	
Plating Shop	801	Rinse Waters	
		Waste Acid/Chrome Solutions	
		Waste Cyanide Solutions	
Etch Circuitry Shop or Printed Wire Board Area	801, Currently 810	Waste Acid/Chrome Solutions	
		Waste Cyanide Solutions	

Sources: HAC, 1984; E&E, 1981; HAC, July 1957; HAC, 1958; and Wilson, 1973.

[1]A dotted line indicates that sufficient information was not available to confirm when the waste generation and/or management practice began and ceased.

Key to Waste Management Abbreviations:

ON	On-Site	STOR	Storage	B-WWT	Batch Wastewater Treatment	TNK	Tank
OFF	Off-Site	RECL	Reclamation	F-WWT	Flow-Through Wastewater Treatment	DRM	Drum
DISP	Disposal	SSD	Storm Sewer Discharge	Z-WWT	Zero-Discharge Wastewater Treatment		

Table 4-1. Industrial Operations (Shops) Waste Management (continued)

Industrial Shop	Locations	Waste Materials	Waste Management Methods[1]
			1952 1956 1962 1977 1984
		Waste Alkaline Solutions	ON SSD or ON B-WWT/ F-WWT and SSD; ON Z-WWT (1952–1977)
		Rinsewaters	ON SSD or ON B-WWT/ F-WWT and SSD; ON Z-WWT (1952–1977)
		Spent Trichloroethylene	ON DISP (1952–1966); DRM STOR and OFF DISP/RECL (1972–1982)
		Spent 1,1,1-Trichloroethane	ON DISP (1952–1966); TANK STOR and OFF DISP/RECL
		Spent Methylene Chloride	ON DISP (1952–1966); ON DISP or OFF DISP/RECL (1976); DRM STOR and OFF DISP/RECL (1982)
Deburr Shop	801, Currently 814	Wastewaters	ON DISP; ON Z-WWT (1952–1977)
Heat Treatment Shop	801, Currently 814	Salt Removal Rinsewaters	ON SSD; ON Z-WWT (1952–1977)

Sources: HAC, 1984; E&E, 1981; HAC, July 1957; HAC, 1958; and Wilson, 1973.

[1]A dotted line indicates that sufficient information was not available to confirm when the waste generation and/or management practice began and ceased.

Key to Waste Management Abbreviations:

ON	On Site	STOR	Storage	B-WWT	Batch Wastewater Treatment,	TNK	Tank
OFF	*Off Site*	RECL	Reclamation	F-WWT	Flow-Through Wastewater Treatment	DRM	Drum
DISP	Disposal	SSD	Storm Sewer Discharge	Z-WWT	Zero-Discharge Wastewater Treatment		

Table 4-1. Industrial Operations (Shops) Waste Management (continued)

Industrial Shop	Locations	Waste Materials	Waste Management Methods[1]
Paint Shops	801, Currently 814; 816; and 830	Paint Sludge	ON SSD or ON DISP (Late 1950s) → ON Z-WWT (1977)
		Waste Thinners	ON DISP (1952) → DRM STOR and OFF DISP/RECL (1977)
		Spent Solvents, N.O.S.	ON DISP (1952) → ON DISP or OFF DISP/RECL (1966) → DRM STOR and OFF DISP/RECL (1976)
Plastic Shop	801, Currently 814	Spent Solvents, N.O.S.	ON DISP (1952) → ON DISP or OFF DISP/RECL (1966) → DRM STOR and OFF DISP/RECL (1976)
Vehicle Maintenance Steam Cleaning Area	833	Rinsewaters	Sanitary Sewer Discharge (1956)

Sources: HAC, 1984; E&E, 1981; HAC, July 1957; HAC, 1958; and Wilson, 1973.

[1] A dotted line indicates that sufficient information was not available to confirm when the waste generation and/or management practice began and ceased.

Key to Waste Management Abbreviations:

ON	On-Site	STOR	Storage	B-WWT	Batch Wastewater Treatment	TNK	Tank
OFF	Off-Site	RECL	Reclamation	F-WWT	Flow-Through Wastewater Treatment	DRM	Drum
DISP	Disposal	SSD	Storm Sewer Discharge	Z-WWT	Zero-Discharge Wastewater Treatment		

Table 4-2. RECENT WASTE GENERATION RATES BASED ON AFP 44'S ANNUAL GENERATOR REPORTS

Waste	Chemical Concentration[1]	Generation Rate (lbs)	On-site Wastewater Treatment (lbs/yr)	Off-site Disposal (D) or Recycling (R)
1,1,1-Trichloroethane[2]	60-93 percent by weight	129,000		129,000 (R)
Methylene Chloride[2]	60-93 percent by weight	3,044		3,044 (R)
Trichlorotrifluoroethane[2]	60-93 percent by weight	3,600		3,600 (R)
Waste Solvents (N.O.S.)[2]	(A)	67,000		67,000 (R)
Spent Chrome Plating Solutions[2]	600 ppm (avg.)	1,964,000	1,964,000	
Spent Cyanide Plating Solutions[2]	0-300 (ppm)	354,000	354,000	

[1]Concentration Key:

(A) Typically varies from 30 percent dichloromethane, 20 percent methanol, minor amounts of other organics plus water, to 95 percent water, plus minor amounts of various organics.

(B) Cake from sludge drying beds in the wastewater treatment plant consists principally of diatomaceous earth with a variety of insoluble, heavy metal hydroxides.

(C) Concrete flooring debris from a plating shop was not analyzed, but probably had adsorbed minor amounts of materials peculiar to this type of operation.

[2]Annual Generator Report, 1983

[3]Annual Generator Report, 1982

[4]Annual Generator Report, 1981

[5]Generated infrequently

Table 4-2. RECENT WASTE GENERATION RATES BASED ON AFP 44'S ANNUAL GENERATOR REPORTS (Continued)

Waste	Chemical Concentration[1]	Generation Rate (lbs)	On-site Wastewater Treatment (lbs/yr)	Off-site Disposal (D) or Recycling (R)
Plating Rinse Waters[2]	Cyanide at 1.0 ppm (max.), 0 percent at 90 percent of the time	$1,095 \times 10^6$	$1,095 \times 10^6$	
Ammonia Hydroxide[2]	10 percent ammonia hydroxide, 17 percent copper, 32 percent chloride and H_2O	16,600		16,600 (R)
Cupric Sulphate[2]	2 percent copper, 20 percent sulphate, 70 ppm chloride	13,700		13,700 (D)
Cutting Oils[2]	98 percent	36,000		36,000 (R)
Diesel Oil[2]	98 percent	4,300		4,300 (R)
Sludge Cake[2]	(B)	45,000[5]		45,000 (D)

[1]Concentration Key:

(A) Typically varies from 30 percent dichloromethane, 20 percent methanol, minor amounts of other organics plus water, to 95 percent water, plus minor amounts of various organics.

(B) Cake from sludge drying beds in the wastewater treatment plant consists principally of diatomaceous earth with a variety of insoluble, heavy metal hydroxides.

(C) Concrete flooring debris from a plating shop was not analyzed, but probably had adsorbed minor amounts of materials peculiar to this type of operation.

[2]Annual Generator Report, 1983

[3]Annual Generator Report, 1982

[4]*Annual Generator Report*, 1981

[5]Generated infrequently

Table 4-2. RECENT WASTE GENERATION RATES BASED ON AFP 44'S ANNUAL GENERATOR REPORTS (Continued)

Waste	Chemical Concentration[1]	Generation Rate (lbs)	On-site Wastewater Treatment (lbs/yr)	Off-site Disposal (D) or Recycling (R)
Corrosive Solids, N.O.S.[2]	(C)	105,000[5]		105,000 (D)
Water-Soluble Machinery Coolants[2]	60-80 percent oil	21,000		21,000 (D)
Spent Trichloro-ethylene[3]	—	1,200		1,200 (R)
Mercury, Metallic[3]	--	60		60 (R)
Paraformaldehyde[3]	--	300[5,6]		300 (D)
Isopropanol[3]	--	500		500 (D)
PCBs[4]	--	500[5,6]		500 (D)

[1]Concentration Key:

(A) Typically varies from 30 percent dichloromethane, 20 percent methanol, minor amounts of other organics plus water, to 95 percent water, plus minor amounts of various organics.

(B) Cake from sludge drying beds in the wastewater treatment plant consists principally of diatomaceous earth with a variety of insoluble, heavy metal hydroxides.

(C) Concrete flooring debris from a plating shop was not analyzed, but probably had adsorbed minor amounts of materials peculiar to this type of operation.

[2]Annual Generator Report, 1983

[3]Annual Generator Report, 1982

[4]Annual Generator Report, 1981

[5]Generated infrequently

[6]Rate is for one event

Health. Records of historical generation rates were, for the most part, not retained. However, industrial waste generation was minimal between 1951 and 1955 because of low production activity during that time period.

Spent unspecified solvents were generated by various shop activities and could have included 1,1-dichloroethylene, methyl ethyl ketone, stoddard solvents, toluene, and methylene chloride (JRB, 1983). The chemical purchase list and process tank list found in Appendix H provide additional insight regarding chemicals used at industrial shops at AFP 44 and which consequently may have been found in wastes during the period between 1969 and 1971. Section 4.6.1, Industrial Wastewater Treatment, describes in detail the treatment and disposal methods used for the various wastewaters historically generated by industrial activities at AFP 44.

The sections which follow describe waste management by the specific industrial shop. Figure 4-1 illustates the locations of those disposal sites referenced in parentheses within the sections. The figure also illustrates the locations of other disposal sites which will be discussed in Section 4.6.3, Waste Disposal.

4.1.1 Machine Shop (Building 801)

Machine Shop operations in Building 801 have included general machining, numerical control, tooling, and TOW missile fabrication. Wastes generated have included waste machining coolants, waste machining lubricants, and various unspecified solvents. Historical generation rates for these wastes were not retained.

From 1952 to 1966, all of the above wastes were collected and transferred to disposal pits or trenches located in the southeastern portion of AFP 44 (Sites 1 or 2). Quantities were small due to low production rates. Waste machining lubricants were sometimes used as dust suppressants from the middle 1950s to the middle 1960s. Section 4.6.5 provides further information on this activity. Since 1966, the waste machining coolants and oils have been collected, stored on-site in tanks, and transferred off-site for disposal.

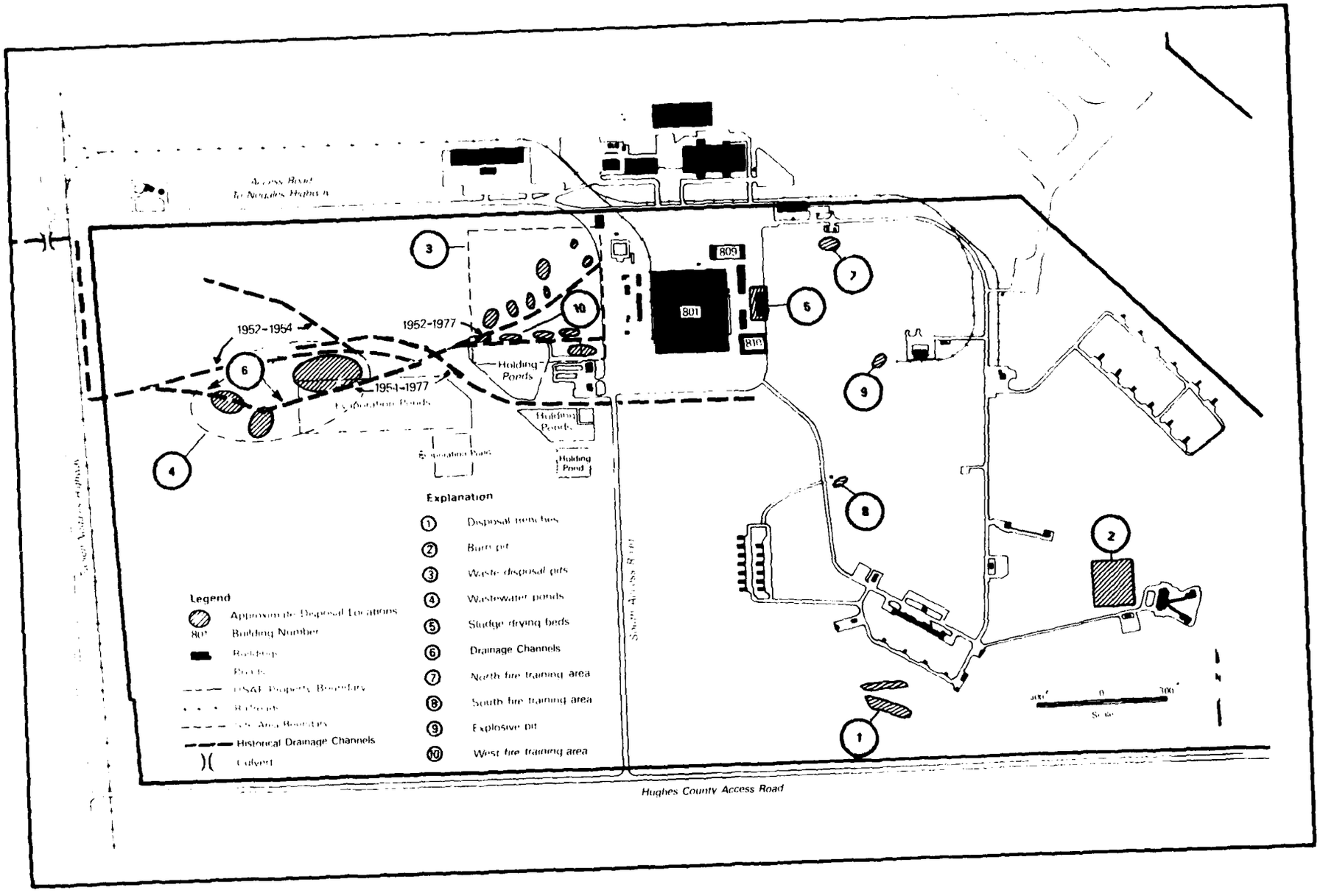


Figure 4-1. Past Disposal Locations at AFP 44, Tucson, Arizona

From 1966 to 1976, the solvents were either disposed on-site in disposal pits west of Building 801 (Site 3) or sent off-site for recycling or disposal. Since 1976, these solvents have been stored in drums and transferred off-site for recycling or disposal. Metal chips from machining have always been collected in dumpsters and sent off-site for recycling.

4.1.2 Assembly Shops (Building 801)

Assembly Shop operations have supported TOW, Maverick, Phoenix, and Roland missiles and systems. Wastes generated have included spent 1,1,1-trichloroethane, trichloroethylene, and other unspecified solvents. Historical generation rates were not retained.

From 1952 to 1966, the above wastes were disposed on-site in disposal trenches and pits located in the southeast corner of the facility (Sites 1 or 2). From 1966 to present, spent 1,1,1-trichloroethane was collected, stored in tanks, and sent off-site for reclamation or disposal. From 1966 to 1972, trichloroethylene was reportedly collected, stored in drums, and sent off-site for reclamation or disposal. From 1972 until at least 1982, spent trichloroethylene was generated only sporadically in small quantities. From 1966 to 1976, unspecified solvents were either disposed on-site in disposal pits west of Building 801 (Site 3) or sent off-site for recycling or disposal. Since 1976, unspecified solvents have been stored in drums and transferred off-site for recycling or disposal.

4.1.3 Spot Welding Shop (Building 801) and Maintenance Welding Shop (Building 830)

Spot welding operations in support of missile construction activities occurred in Building 801 from the 1970s to the present. Smaller welding operations have also occurred in Building 830. Operations from these locations generated spent 1,1,1-trichloroethane, trichloroethylene, caustics, rinsewaters, and waste acids.

From 1952 to 1966, spent 1,1,1-trichloroethane and trichloroethylene were disposed on-site in disposal pits (Sites 1 or 2). Since 1966, these solvent

wastes have been collected, stored in tanks or drums, and sent off-site for reclamation or disposal.

From 1952 to 1954, caustics and rinsewaters were collected in a dilution tank for pH adjustment and discharged into the storm sewer and a drainage channel (Site 6). From 1954 to 1977, these wastes were discharged as above; and contained on AFP 44 property in wastewater holding ponds (Site 4) constructed west of the present wastewater treatment plant. Since 1977, caustics and rinsewaters have been treated on-site and discharged to lined evaporation ponds at the zero-discharge treatment plant. Waste acids were batch treated and discharged into the storm sewer system and drainage channel until 1977, when treatment of these wastes began at the zero-discharge plant.

Historical generation rates for solvents were not retained. Section 4.6.1, Industrial Wastewater Treatment, provides generation estimates for all rinsewaters generated at AFP 44.

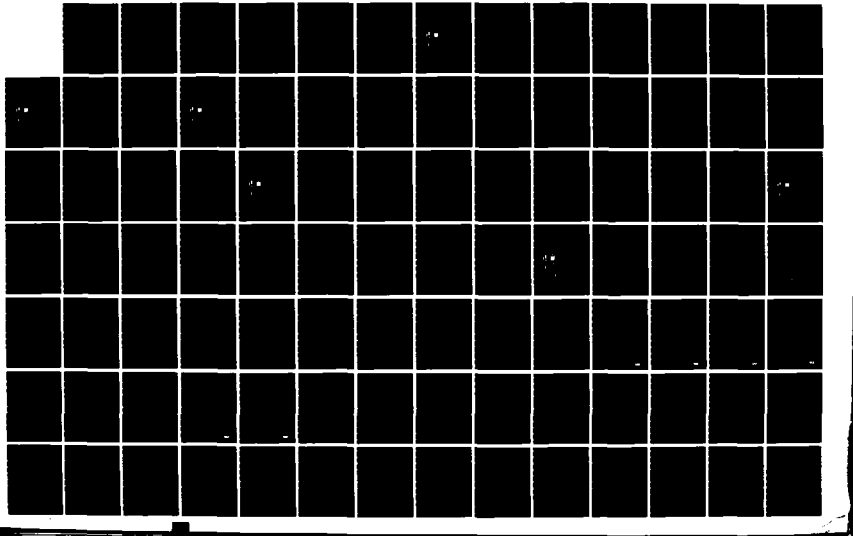
4.1.4 Process Shops

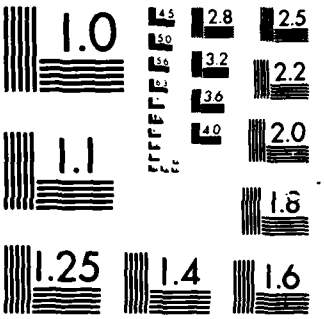
The major process shops have been located in Buildings 801, 810, and 814 and consist of the following:

- Plating Shop (Building 801)
- Etch Circuitry Shop/Printed Wireboard Area (Building 810)
- Deburr Shop (Building 814)
- Heat Treatment Shop (Building 814)
- Paint Shop (Building 814)
- Plastic Shop (Building 814).

The wastes generated from these activities are described below by each shop.

AD-A163 889 INSTALLATION RESTORATION PROGRAM PHASE I RECORDS SEARCH 2/3
AIR FORCE PLANT 44 TUCSON ARIZONA(U) SCIENCE
APPLICATIONS INTERNATIONAL CORP MCLEAN VA OCT 85
UNCLASSIFIED F33657-81-E-2096 F/G 13/2 NL





4.1.4.1 Plating Shop (Building 801)

The Plating Shop is located on the east side of Building 801 and has been used for the plating, anodizing, and chemical coating of metal subassemblies (Wilson, 1973). Plating operations typically generated wastes which contained heavy metals; such as electroplating rinsewaters, waste acid/chrome solutions, and waste cyanide solutions (JRB, 1983; E&E, 1981).

From 1952 to 1954, waste cyanide solutions, concentrated chromic acid solutions, and rinsewaters were batch treated and discharged to the storm sewer which emptied into the drainage channel west of Building 801 (Site 6). The batch treatment of acid/chrome- and cyanide-containing wastewaters continued until 1977. Beginning in 1962, the electroplating rinsewaters which did not bear cyanide or chromic acid were either treated by a flow-through treatment facility (E&E, 1981) or were discharged directly to the storm sewer system (Wilson, 1973). Since 1977, rinsewaters, along with the chrome and cyanide solutions, have been treated in the zero-discharge wastewater treatment plant.

4.1.4.2 Etch Circuitry Shop/Printed Wire Board Area (Building 810)

The Etch Circuitry Shop, originally located on the east side of Building 801, was moved to Building 810 in 1984. The shop is currently referred to as the Printed Wire Board Area. Waste generating activities in the shop involve circuit board cleaning, plating, marking, and etching. Wastes historically generated from these activities include the following:

- Waste acid and chrome solutions including hydrochloric acid, sulfuric acid, and fluoroboric acid
- Waste alkaline solutions including sodium hydroxide, potassium hydroxide, sodium silicates, sodium phosphates, and sodium nitrates
- Waste cyanide solutions
- Trichloroethylene
- Methylene chloride
- 1,1,1-Trichloroethane.

From 1952 to 1962, the waste acid and chrome solutions were batch treated and the treated effluent was discharged into the storm sewer which emptied into the drainage channel (Site 6). From 1962 to 1977, a flow-through process wastewater treatment plant was used to neutralize and precipitate heavy metals from these wastes. During this period, treated wastes were discharged into the storm sewer and drained to holding ponds (Site 4). Since 1977, these wastes have been treated in the zero-discharge wastewater treatment plant.

From 1952 to 1954, waste cyanide solutions were neutralized in a dilution tank and treated wastewaters were discharged to the storm sewer system. From 1954 to 1977, cyanide wastewaters were treated using a more complex batch treatment process, and the treated effluent continued to be discharged to the storm sewer. Since 1977, cyanide rinsewaters have been treated in the zero-discharge wastewater treatment plant.

Solvent wastestreams historically generated from the Etch Circuitry Shop/Printed Wire Board Area (i.e., trichloroethylene, methylene chloride, and 1,1,1-trichloroethane) have been managed as described earlier for solvent wastes from other shops (Sections 4.1.1, 4.1.2, and 4.1.3).

4.1.4.3 Deburr Shop (Building 814)

The deburring process area was also originally located in Building 801 and was moved to Building 814 in 1984. This process generates deburring wastewater generally containing metals. From 1952 to 1977, these wastewaters were disposed into the storm sewer system. Since 1977, deburring wastewater has been treated on-site and discharged to lined evaporation ponds at the zero-discharge facility.

4.1.4.4 Heat Treatment Shop (Building 814)

The Heat Treatment Shop was originally located in Building 801 and was moved to Building 814 in 1984. The shop has generated non-contact cooling water from a vapor degreaser, salt removal rinsewaters, and possibly spent solvents. From 1952 to at least 1977, the rinsewaters were discharged to the

storm sewer system and into ponds located west of 801 (Site 4) (HMI, 1982a). Since 1977, the wastewaters have been discharged on-site to the zero-discharge wastewater treatment plant.

4.1.4.5 Paint Shop (Building 814)

The process Paint Shop was also located in Building 801 and moved to Building 814 in 1984. The wastes generated have included paint sludges, waste thinners, and unspecified waste solvents.

From 1952 to 1955, the paint sludges and paint thinners were discharged to disposal trenches located in the southern part of the facility (Site 1). From 1955 to 1966, these wastes were disposed in pits located in the southeastern part of the facility (Site 2); and, from 1966 to 1977, in pits located in the area west and northwest of Building 801 (Site 3) (HMI, 1982a). From 1977 to the present, paint sludges have been treated on-site in the zero-discharge wastewater treatment plant. Since 1977, waste thinners have been stored in drums on-site and transferred off-site for recycling and disposal.

Waste solvents were disposed on-site in disposal trenches located in the southern part of the facility from 1952 to 1955 (Site 1), and in the southeast from 1955 to 1966 (Site 2). From 1966 to 1976, the solvents were disposed either on-site in disposal pits west of Building 801 (Site 3), or sent off-site for recycling or disposal (HMI, 1982a). From 1976 to present, unspecified solvents have been stored in drums and transferred off-site for recycling or disposal.

4.1.4.6 Plastic Shop (Building 814)

The Plastic Shop was also located in Building 801 and moved to Building 814. The shop generates wastes consisting of unspecified solvents. The past and present waste management practices associated with this process are the same as described previously for other unspecified solvents.

4.1.5 Electronic Assembly Shop (Building 809)

The Electronic Assembly Shop is located in Building 809. Waste streams were not identified as generated by this operation.

4.1.6 Maintenance Machine Shop (Building 816)

The Maintenance Machine Shop is located in Building 816. Aluminum and steel machining and coolant removal operations have generated waste machining coolants, waste machining lubricants, and various unspecified solvents. Generation rates have been small and infrequent.

The management practices for these wastes are the same as described above in Section 4.1.1, Machine Shop (Building 801).

4.1.7 Maintenance Paint Shop (Building 816)

The Maintenance Paint Shop is located in Building 816. Operations generate paint sludges, waste thinners, and unspecified waste solvents. Generation rates have been small and infrequent. The management practices for these wastes are the same as described in Section 4.1.4.5, Paint Shop (Building 814).

4.1.8 Cabinet Shop (Building 830)

The Cabinet Shop is located in Building 830. Wastes were not reported as generated by this operation.

4.1.9 Paint Shop (Building 830)

A Paint Shop is located in Building 830. Typical wastes generated from this operation are paint sludges, waste thinners, and unspecified waste solvents. Generation rates are small and infrequent. The past and current waste management practices are the same as described above regarding other paint shops.

4.1.10 Sheet Metal Shop (Building 830)

The Sheet Metal Shop is located in Building 830. Wastestreams are not generated, except for scrap metal which has always been reclaimed off-site.

4.1.11 Vehicle Maintenance Steam Cleaning Area (Building 833)

A steam cleaning pad and drain system was installed in 1956 at Building 833 for use during the cleaning of motor vehicles. The area generates rinsewaters, which flow to the sanitary sewer system after passing through a grease trap. This disposal practice has remained unchanged since 1956. The rate of flow is sporadic. Grease trap wastes are removed about once per year, placed in barrels, and disposed in accordance with relevant regulations. The grease trap capacity is approximately 8 gallons.

4.2 BULK RAW MATERIAL STORAGE

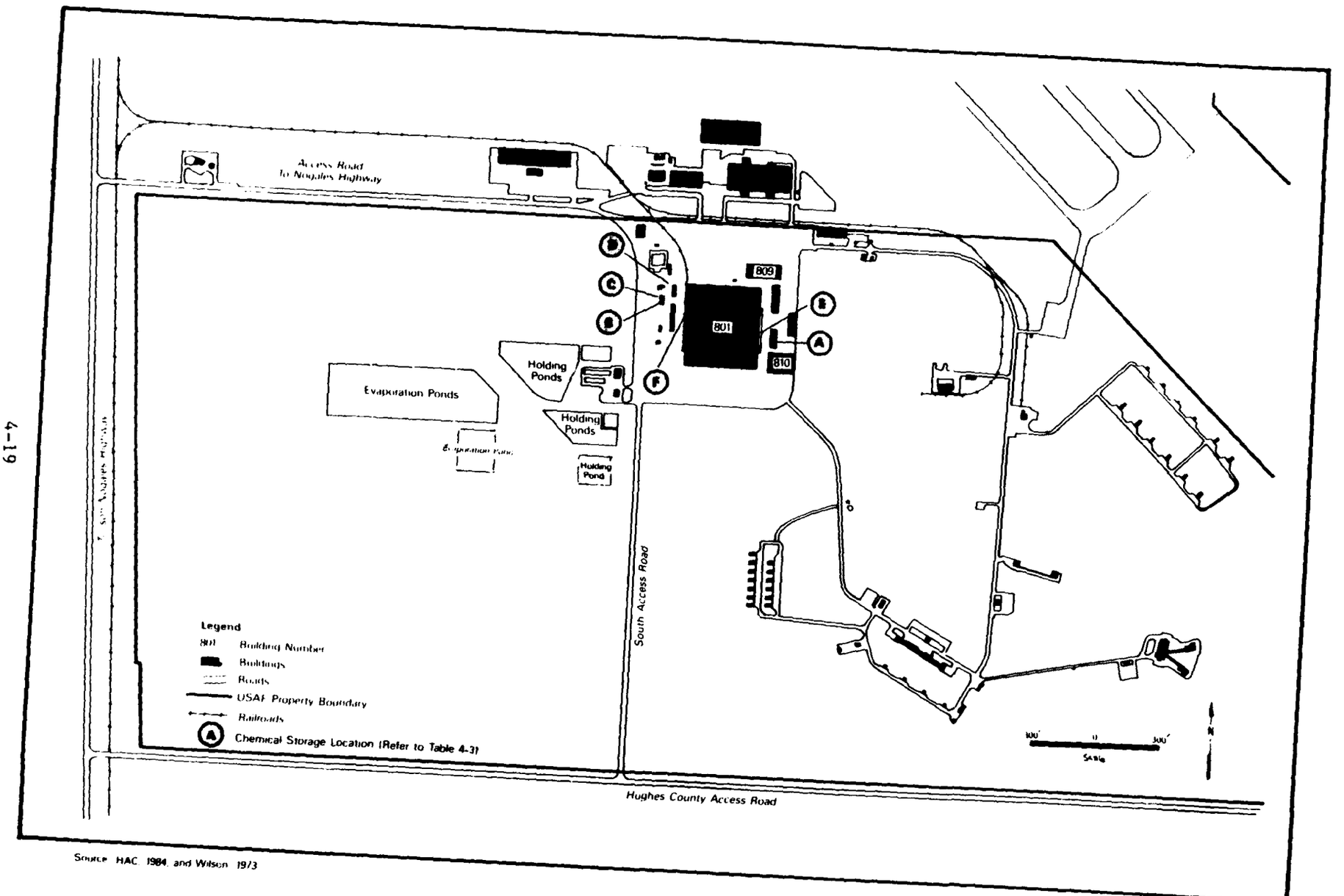
AFP 44 has stored explosives, chemicals, and petroleum fuels on-site and in bulk quantities in support of various operations. The storage of explosives has been restricted to the FACO areas. Class A explosives have been stored in the storage magazines and at Buildings 866 and 870, which are missile shipping and receiving facilities. The explosives are brought in by trucks. The bulk storage of chemicals and petroleum fuel are described individually in Sections 4.2.1 and 4.2.2, respectively.

4.2.1 Chemical Storage

Chemicals used as raw materials in processing are stored at AFP 44 in tanks, cylinders, barrels, and segregated cells based on the type of chemical. There are four designated areas for bulk chemical storage. The current designated areas of storage are the following:

- Building 817, chemical storage
- Building 826, acid storage
- Building 827, cylinder storage
- Building 829, flammable storage.

In addition to these designated raw material storage areas, various chemicals are stored in tanks throughout the plant. Figure 4-2 and Table 4-3 locate and summarize the areas of designated chemical storage. Table 4-4 summarizes the chemical storage which occurs in both above- and underground



Source: HAC, 1984, and Wilson, 1973

Figure 4-2. Historically Designated Areas of Bulk Chemical Storage at AFP 44, Tucson, Arizona

Table 4-3. HISTORICALLY DESIGNATED AREAS OF BULK CHEMICAL STORAGE AT AFP 44

Location ID (Figure 4-2)	Description of Location	Material Stored	Description of Storage	History
A	Building 817, Chemical Storage	All chemicals except flammables and acids	Bought in bulk and stored in tanks or repackaged into smaller containers; piped to processes from tanks or provided upon request by process shops	Used for chemical storage since 1976
B	Building 826, Acid Storage	Acids	Stored in segregated cells, used in various processes	Used for acid storage since 1961
C	Building 827, Cylinder Storage	Gases, including oxygen, acetylene, argon, and helium	Stored in cylinders	Used for gas storage since 1961
D	Building 829, Flammable Storage	Flammables; including paints, thinners, solvents, and oils	Stored in barrels on racks with dispensing faucets, distributed via delivery to users	Used for flammables storage since 1954
E	East Side of Building 801, Chemical Storage	Various processing chemicals and gases	Various containers	Used for chemical storage through 1976
F	West Side of Building 801, Chemical Storage	Chemicals used by maintenance, including solvents	Drums	Used for chemical storage through 1976

Sources: HAC, 1984; Wilson, 1973

Table 4-4. LISTING OF CHEMICAL STORAGE TANKS AT AFP 44

Location	Contents and Description	Capacity (gallons)
Aboveground, wastewater treatment plant	Sodium hydroxide tank	16,919
	Polymer tank	10,575
	Acid tank	5,640
Aboveground, southeast of Building 827	Liquid propane tank	500
Aboveground, outside north wall of Building 801	Liquid nitrogen, two tanks	9,300 each
Underground, between Buildings 801 and 810	Trichloroethane, two tanks	10,000 each
Aboveground, outside west wall of Building 817	Developer (sodium carbonate in water), two tanks	500 each
	Stripper supply (glycol ether and ethanolamine in water), two tanks	500 each
	Starter solution (ammonium chloride, copper chloride, ammonia, and copper, in water), two tanks	500 each
	Finisher solution tank (fluoroboric acid and thiourea in water)	1,500
	Ferric chloride tank (ferric chloride and hydrochloric acid in water)	1,500
Aboveground, outside east wall of Building 817	Sodium hydroxide tank	6,000
	Hydrochloric acid tank	6,000
	Fresh ammoniacal etch tank (ammonium chloride and ammonia in water)	6,000

Table 4-4. LISTING OF CHEMICAL STORAGE TANKS AT AFP 44 (Continued)

Location	Contents and Description	Capacity (gallons)
Aboveground, inside Building 817	Caustic electroless tank (sodium hydroxide and potassium hydroxide)	268
	Sodium hydroxide solution tank	272
Aboveground, outside south wall of Building 809	Liquid nitrogen, three tanks	9,300 each
Aboveground, west of Building 814	Liquid nitrogen tank	3,200 each
Aboveground, outside south wall of Building 814	Methanol, two tanks	100 each
Aboveground, outside, northwest of Building 814	Concentrated nitric acid tank	6,000

Source: HAC Facility Site Map, Existing Tank Locations, March 1984.

tanks. Evidence was not found during the Phase I visit that major spill incidents in conjunction with chemical storage has occurred at AFP 44.

Prior to the activation of Building 817 in 1976 for chemical storage, chemicals were stored at AFP 44 in Buildings 826, 827, 829, and at the east and west sides of Building 801. The information regarding these storage areas was obtained from a Water Pollution Control Study conducted at AFP 44 in 1973 (Wilson) except where otherwise noted.

Buildings 826 and 827 were activated in 1961 and Building 829 in 1954. These buildings have always been used for the same chemical storage as at present; namely the storage of acids, gases, and flammables. These buildings, although now enclosed, were originally only covered with canopies. Flammables stored at Building 829 included solvents, oils, paints, and waxes (HAC, 1969).

The canopy along the east side of Building 801 was used as a storage area for a large number of chemicals used in processing. Etch circuitry and plating shop chemicals, demineralizers, drums of lubricants and solvents and chemicals and gases used in wastewater treatment were stored in this area. Drums of solvents, cleaning compounds, and lubricants used by the Maintenance Department were stored at the loading dock on the west side of Building 801.

Building 817, built approximately 8 years ago for centralized chemical storage, currently contains chemical tanks of various capacities. Floor drains connected to the wastewater treatment plant provide for the collection of accidental spillage. Chemicals from the tanks are piped via distribution lines to the areas of use. Based on observance of the distribution lines and tanks surrounding the building and based on a listing of tanks in the area (HAC Facility Site Map, Existing Tank Locations, March 1984), the following raw materials are currently located at Building 817:

- Developer solution (sodium carbonate, water, and antifoam)
- Stripper (glycol ether, ethanolamine, water)
- Starter solution (ammonium chloride, copper chloride, ammonia, copper, water)

- Finisher solution (fluoroboric acid, thiourea, water)
- Ferric chloride
- Sodium hydroxide
- Hydrochloric acid
- Ammoniacal etch (ammonium chloride, ammonia, water)
- Caustic electroless solution (sodium hydroxide, potassium hydroxide)
- Sodium hydroxide solution
- Ammonia gas
- Nitrogen gas
- Halocarbon K-14
- Freon gas
- Chlorine gas
- Cadmium
- Cyanide.

Cadmium and cyanide are stored in locked boxes, outside the west wall of Building 817. An ammoniacal etchant has been used since 1982 and is reported to also contain copper chloride.

In addition to the above designated storage areas, process chemicals are currently stored in tanks at various other plant locations. These include the following (HAC Facility Site Map, Existing Tank Locations, March 1984):

- Wastewater treatment plant - chemicals used in treatment, such as sodium hydroxide, a polymer, and acid
- Various locations - liquid propane and liquid nitrogen
- Building 814 - methanol and concentrated nitric acid
- Between Buildings 801 and 810 - 1,1,1-trichloroethane.

Trichloroethylene (TCE) was used in process activities at AFP 44, but its use has now been discontinued. TCE was purchased in 55-gallon drums from 1952 to 1971. An aboveground distribution system piped the trichloroethylene to areas of plant use.

In 1971, two underground tanks for the storage of 1,1,1-trichloroethane (TCA) were installed. TCE use gradually decreased until all of the plant process equipment was modified for TCA use. At this time, all TCE use was discontinued at AFP 44. Aboveground tanks and containment areas for storage of bulk chemicals have been designed, and the bulk TCA tanks are scheduled to be removed by December 1985.

4.2.2 Fuel Storage

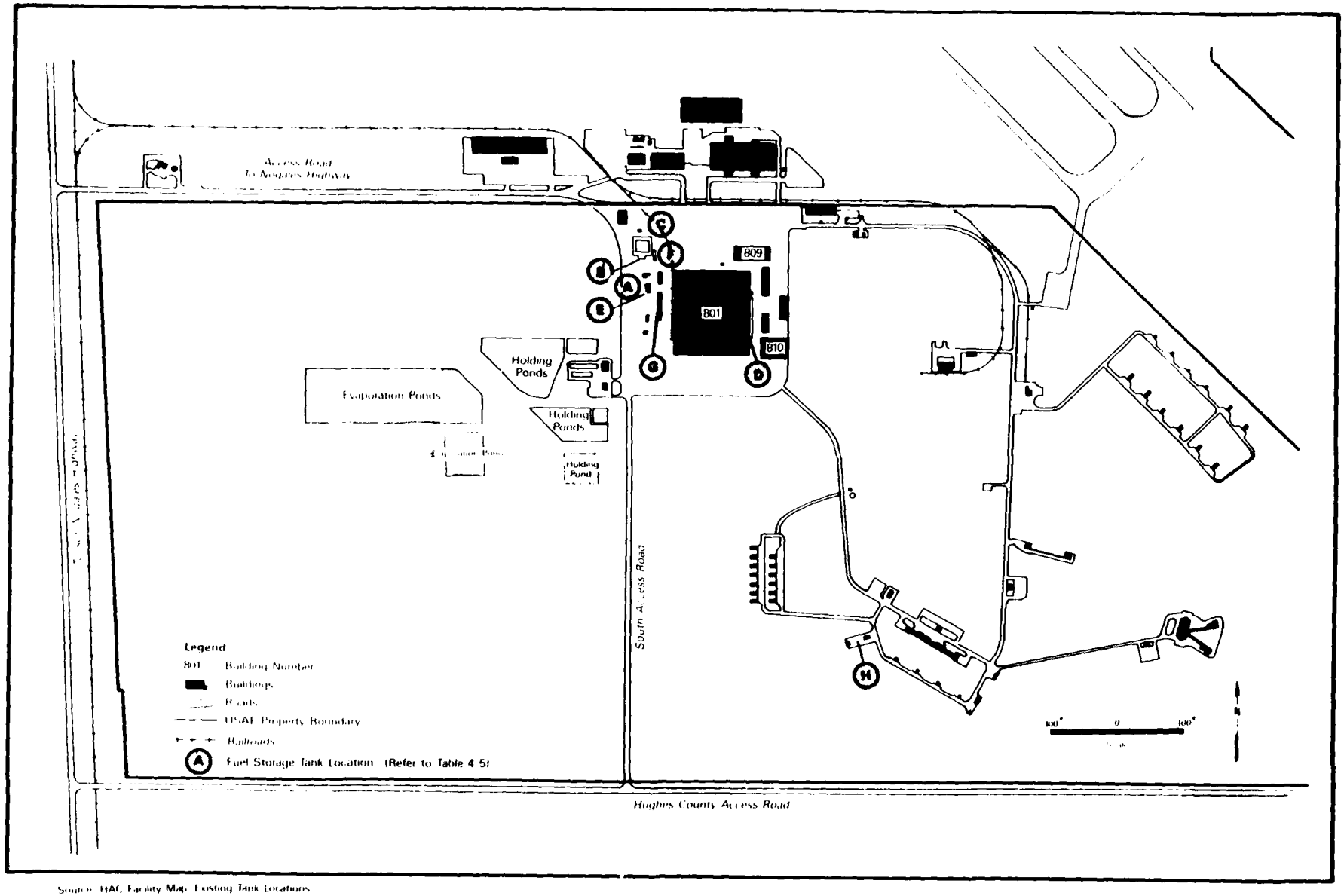
Current and historical fuel storage activities at AFP 44 have involved the underground and aboveground storage of gasoline and No. 2 fuel oil (or diesel fuel). Figure 4-3 and Table 4-5 summarize the location and status of fuel storage at AFP 44. All underground fuel tanks, except a fuel tank east of Building 801 (Location D), have been removed. The remaining underground fuel tank has been in use for at least 20 years and is pressure tested twice a year. Past testing of underground tanks at three locations on AFP 44 indicated that the structural integrity of the tanks was questionable because of their failure to pass the test. The tanks and their status are as follows:

- Two gasoline tanks, west of Building 833, removed in 1982 and had leaked (Location G on Figure 4-3)
- One diesel fuel tank, between Buildings 801 and 810, scheduled for removal in the near future (Location D on Figure 4-3)
- Two diesel fuel tanks, removed in March of 1985 and had not leaked, FACO assembly and test area (Location H on Figure 4-3).

A detailed discussion of the test results and any subsequent remedial activities is included in Section 4.5, Fuel Tank Incidents.

4.3 PEST AND VEGETATION CONTROL

Off-site contractors have always been used for pest and vegetation control activities at AFP 44. Typical pests, other than insects, requiring control have included mice, rats, and rattlesnakes. From the early 1970s to the present, areas within the immediate vicinity of fences have also been sprayed to kill vegetation and ensure visibility for security reasons. Granular urea bore has always been used as the herbicide, and the effect lasts for 6 to



Source: HAC Facility Map: Existing Tank Locations
March 1984 and HAC, 1984

Figure 4-3. Current and Past Locations of Fuel Storage Tanks at AFP 44, Tucson, Arizona

Table 4-5. LISTING OF FUEL STORAGE TANKS AT AFP 44

Location (Figure 4-3)	Description of Location and Status	Fuel Type and Description	Capacity (gallons)
A	Aboveground, west of Buildings 826 and 827	Gasoline, two tanks	10,000 each
B	Aboveground, south of Building 837	Diesel fuel, two tanks	250 each
C	Aboveground, north of Building 837	Diesel fuel tank	250
D	Underground, between Buildings 801 and 810	Diesel fuel tank	10,000
E	Aboveground, south of Building 826	Diesel fuel tank	350
F	Underground, east of Building 837, removed in March of 1985	Diesel fuel tank	600
G	Underground, west of Building 833, removed in 1982	Gasoline tank	3,000
		Gasoline tank	10,000
H	Underground, FACO assembly and test area, removed in March of 1985	Diesel fuel tank	500
		Diesel fuel tank	3,000
	Underground vault	Replacement diesel fuel tank	3,000

Sources: HAC Facility Map, Existing Tank Locations, March 1984; and HAC, 1984.

7 years. There has not been any widespread pesticide spraying, mixing, storing, containerization, or container reuse at AFP 44.

4.4 FIRE TRAINING

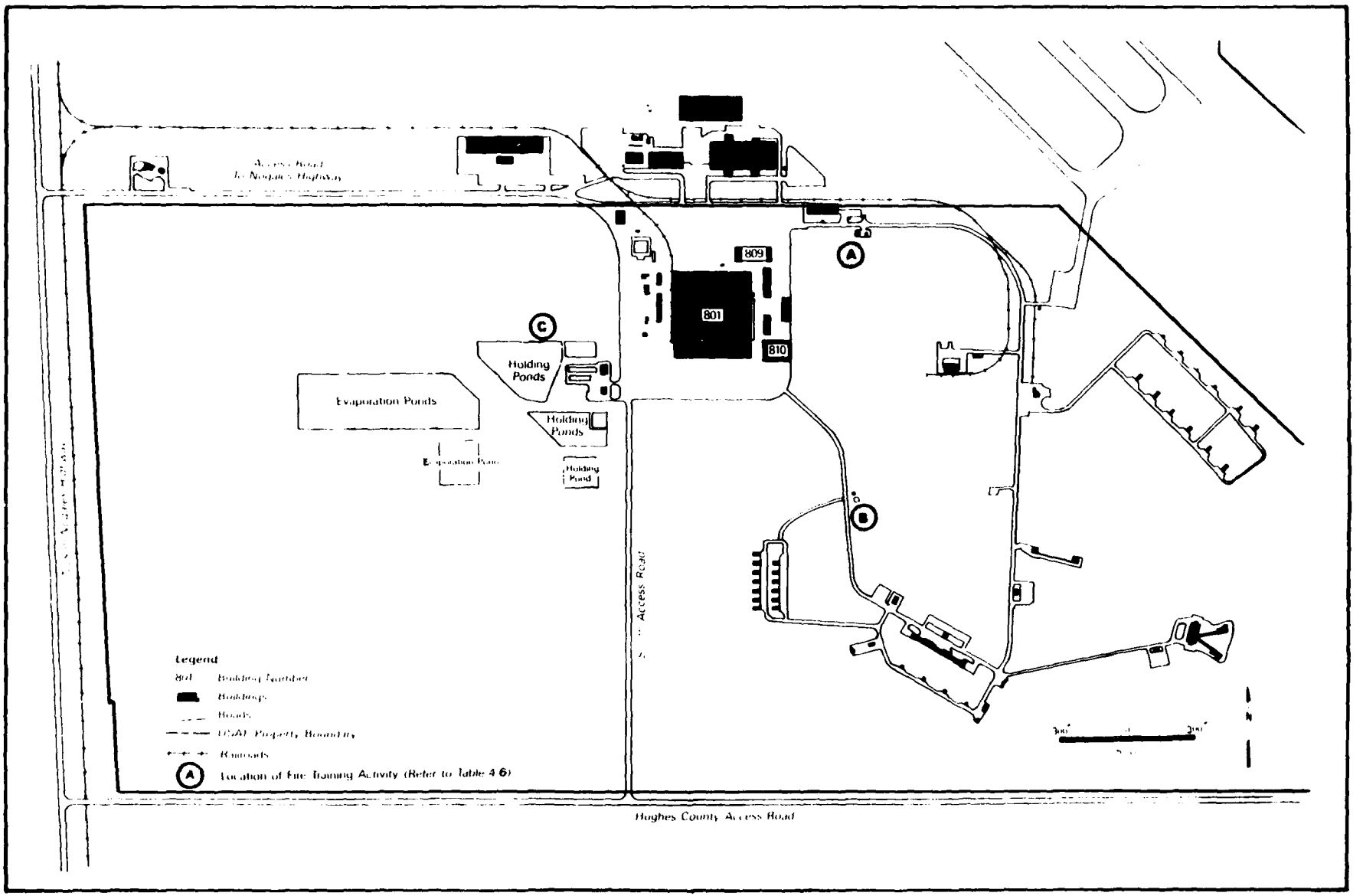
Fire training does not currently occur at AFP 44, but did occur in the past and involved the igniting of various waste materials, particularly solvents. These practices began in the 1950s and ceased in the 1960s (HAC, 1980a).

Generally, the steps in fire training involved pouring the chemicals on the ground, directly or indirectly, and torching the material. The areas were neither cleaned nor scraped after the fires, and were sometimes flushed with large amounts of water.

Three specific locations of fire training at AFP 44 have been identified. Figure 4-4 shows the locations of these areas and Table 4-6 summarizes the related activities and time periods. The paragraphs below discuss each area in detail.

Between the middle and late 1950s, AFP 44 personnel ignited waste solvents and other flammables, such as alcohols, three times a week for one month a year, at a bermed area east of Building 809 (Location A on Figure 4-4). Waste solvents burned included acetones and methyl ethyl ketone (MEK). Generally, two 55-gallon drums of material were poured on the ground surface, ignited, and extinguished with dry powder carbon dioxide extinguishers.

During the early 1960s, the extinguishing of flow fires was practiced at the base of the water towers located in the FACO area (Location B on Figure 4-4). Materials burned included flammable solvents (such as acetones and MEK) and other flammables such as alcohols. Approximately three to five times a year, materials were released from a 150-gallon tank, poured down a sloped tile drain into a trough, and subsequently set afire. A fire truck was used to extinguish the fires with water. The extinguishing of metal and Class A wood fires was also practiced at this location.



Source: HAC 1984

Figure 4-4. Locations of Fire Training Activities at AFP 44, Tucson, Arizona

Table 4-6. SUMMARY OF PAST FIRE TRAINING ACTIVITIES AT AFP 44

Location (Figure 4-4)	Activity Description	Materials Ignited	Approximate Amount Ignited Each Occurrence	Frequency of Activity
A	Surface burning in bermed area	Acetones, MEK, other solvents Alcohols, other flammables	Two 55-gallon drums	Three times a week, one month a year, from middle to late 1950s
B	Flow fires	Acetones, MEK, other solvents Alcohols	Less than 150 gallons	Three to five times a year, from late 1950s to early 1960s
C	Fire extinguisher use training	Solvents	Less than 5 gallons	Weekly, two months per year, late 1950s

Sources: HAC, 1984; and HAC, 1980a.

During the late 1950s, personnel training in the use of carbon dioxide extinguishers was conducted on a roadway west of Building 801 (Location C on Figure 4-4). The wastewater treatment plant's northern holding ponds are now located near the site. For two months a year, small contained fires were ignited on a weekly basis, with less than five gallons of flammable solvents per occurrence. The extinguishing of metal fires was also practiced at this location. Fires were totally extinguished with water.

4.5 FUEL TANK INCIDENTS

Three locations of fuel storage at AFP 44 recently underwent pressure testing and several fuel tanks failed to pass the test. Figure 4-3, referred to in Section 4.2.2, illustrates the locations of these tanks. All of the tanks, except one (Location D on Figure 4-3), have since been removed. No odor or discoloration of surrounding soil was observed during the excavation of two fuel tanks (Location H on Figure 4-3) in March of 1985. These tanks have been replaced with a single 3,000-gallon tank contained in an underground vault.

In 1984, a petro-tight pressure test was performed on two connected gasoline tanks located underground and west of Building 833 (Location A on Figure 4-3). One tank had a capacity of 10,000 gallons and was about 8 feet in diameter, and the other had a capacity of 3,000 gallons and was 6 to 7 feet in diameter. The former was installed around the late 1960s to the middle 1970s, and the latter was installed in the early 1950s. The testing of the tanks indicated that the structural integrity of the tanks was questionable because the tanks failed to pass the tests. According to an observer of the tank removal process, the ground was saturated with fuel from the 3,000-gallon tank, confirming that the tank was leaking. The surrounding soil was excavated to that depth where soil saturation was not evident. Removed soil was tested for the presence of lead to assure that contaminated soil excavation was complete. Excavation occurred to a depth of 18 feet below the tank bottom and to a width of 14 feet from the tank sides. The excavated soil was trucked off-site for disposal at an EPA-permitted facility; the backfill for the excavated area was obtained from a commercial source.

A recent pressure test of an underground 10,000-gallon, diesel fuel tank (Tank No. 38) located between Buildings 801 and 810 (Location D on Figure 4-3) revealed that the tank would not hold pressure, with a test variance of -1.319 gallons per hour. This tank will be removed by the end of 1985 as part of the Air Force program to remove all underground tanks at AFP 44.

An underground, 3,000-gallon tank (Tank No. 100) located in the FACO area (Location H on Figure 4-3) was also recently tested. The testing contractor could not pump sufficient fuel into the tank to build up enough pressure to secure a reading. The test was performed on two occasions (March and September 1984) with the same results. The companion 500-gallon, diesel fuel tank (Tank No. 99) could not be tested in September because of damage to a fuel pipe by a delivery truck. The earlier test in March, however, did reveal that there also could be a problem with the tank. The above tanks were removed in March 1985. A faulty vent on the 3,000-gallon tank was the cause of the test failures. Leakage had not occurred.

4.6 WASTE MANAGEMENT PRACTICES

AFP 44 has in the past treated, stored, and disposed hazardous wastes on-site. In 1977, the land disposal of hazardous waste on-site terminated at AFP 44 (HAC, 1980a). Currently, only authorized wastewater treatment, hazardous waste storage in surface impoundments, and hazardous waste storage for less than 90 days in drums and tanks occurs on-site at AFP 44. Wastes are currently transported between areas within the plant using forklifts, collection carts, or wastewater collection lines; off-site transportation is provided by licensed and contracted haulers (JRB, 1983).

The sections which follow describe the past and current waste management practices at AFP 44, including:

- Wastewater Treatment
- Waste Storage
- Waste Disposal
- Used Container Management
- Used Oil Management and Dust Control

- PCB Management
- Sanitary Sewer and Storm Drainage Systems.

In addition to waste storage and treatment, on-site recycling of treated wastewaters (Section 4.6.1) occurs at AFP 44. Waste solvents and mineral oils (Section 4.1) are recycled off-site.

4.6.1 Industrial Wastewater Treatment

Industrial wastewaters generated by processing operations at AFP 44 have been treated on-site since production began at the facility in the early 1950s. Treatment methods used over the past thirty-two years at AFP 44 have evolved from batch and flow-through to zero-discharge treatment. The following sections chronologically describe these wastewater treatment practices and the wastewaters treated by them.

4.6.1.1 Batch Treatment - 1952 to 1961

In 1952, dilution tanks were used to raise the pH of waste processing solutions, including sulfuric, chromic, hydrofluoric, nitric, hydrochloric, acetic, and phosphoric acids (E&E, 1981). This treatment of acid solutions, with the exception of chromic acid solutions, continued through 1961 (E&E, 1981). After dilution, the wastewaters were carried by branch collection lines into a 30-inch storm drainage line and discharged into a drainage channel west of Building 801 (HAC, 1958; OCE-AF, 1959; E&E, 1981). The drainage channel was originally constructed to convey waters from the plant to a natural drainage wash located approximately one-half mile west of Building 801 (HAC, 1958; E&E, 1981).

In 1954, Hughes Aircraft Company put into operation a batch treatment plant. The treatment plant was located on the east side of Building 801 and was used to treat both dilute and concentrated solutions of chrome- and cyanide-containing wastewaters. Wastewaters from the general factory area and the Heat Treatment Shop not contaminated with chrome or cyanide were drained to the storm sewer system (HAC, 1958). Chrome- and cyanide-free alkaline baths and rinsewaters generated at the plant (OCE-AF, 1959) may have been

included in this discharge, however, data relating to the management of these wastestreams during this period was not located during the Phase I Records Search.

Tanks containing Plating Shop wastewaters not contaminated with chrome or cyanide were drained directly into floor drains connected to the sewer system (HAC, 1957). Wastewaters containing chrome and cyanide were transported to the treatment plant via aboveground piping (HAC, 1958; E&E, 1981). Leakage of these wastewaters from piping and holding tanks occasionally resulted in the accidental discharge of untreated wastestreams into the storm sewer system (HAC, 1958). In 1957, the ASDH notified Hughes regarding the concerns of the City of Tucson, the San Xavier Indian Reservation, the Pima County Health Department, and the State Health Department that the plant's discharges into the system would cause pollution of potable water as the result of the infiltration of chemicals into the groundwater (ASDH, 1957). A major response to these concerns was the revision of the drainage system for the Plating and Etch Circuitry Shops whereby certain floor drains were rerouted to the batch wastewater treatment plant (HAC, 1958).

Drainage from the floor drains and aboveground piping was collected in two retention tanks: one with an 840-gallon storage capacity and originally intended to serve as a pump station, and one with a 9,000 gallon storage capacity. When ready to be treated, the wastewaters were pumped from the retention tanks to the treatment plant. The batch wastewater treatment plant consisted of two 4,500 gallon concrete tanks, and chemical feeders which introduced ferrous sulfate, lime, and chlorine into the tanks. Chemical equipment and storage was housed in an adjacent, small, steel building (HAC, 1958).

Cyanide and chromium wastewaters were batch treated separately. The solutions of sodium and potassium cyanide were oxidized with chlorine (alkaline chlorination) to nitrogen gas and carbon dioxide (HAC, 1958; E&E, 1981). Lime or sodium hydroxide was added to maintain a pH of 8.5 (HAC, 1958; OCE-AF, 1959). The solutions of hexavalent chromic acid were reduced to a trivalent

state with ferrous sulfate and ferric iron, and trivalent chromium was precipitated with lime to form a sludge (HAC, 1958; E&E, 1981). Ferric chloride became available from the Etch Circuitry Shop as a reducing agent, which reduced ferrous sulfate usage at the plant and provided an attractive disposal method for the ferric chloride (HAC, 1958).

After batch treatment, the wastewaters were drained to the storm sewer system and discharged with cooling water blowdown into the drainage channel (HAC, 1958; OCE-AF, 1959). Sludge deposits in the tanks were removed periodically by a commercial septic tank dealer. The drainage channel was sampled daily for the presence of chrome and cyanide, and periodically for other chemicals (HAC, 1958). In 1954, holding ponds were constructed approximately 0.6 miles west of Building 801 and the drainage channel was rerouted to direct the wastewaters into the ponds. One of the ponds was used for backup and was connected to a main pond by a sluice gate (E&E, 1981). The main holding pond was increased in size in 1961 (E&E, 1981). Wastewaters reaching the holding ponds were dissipated by evaporation or percolation. During storm periods, however, the ponds did overflow and wastewaters followed the storm water path (Wilson, 1973).

A total of approximately 400,000 gallons per day (gpd) were reportedly discharged to the drainage channel by AFP 44. A water conservation program at the plant reduced the flow to 130,000 gpd (OCE-AF, 1959). Approximately 40,000 gpd of this discharge was reportedly from the batch wastewater treatment plant (OCE-AF, 1959). However, another source estimated the batch treatment rate of chrome- and cyanide-containing wastewaters as only 20,000 gallons per week, of which 160 gallons were concentrated chrome and cyanide solutions and 70 percent of all solutions contained chromic acids (E&E, 1981).

4.6.1.2 Batch and Flow-through Treatment - 1962 to 1977

A flow-through treatment facility was designed in 1961, added to the batch treatment facilities on the east side of Building 801, and put into service in 1962 (HAC, 1983c). The treatment system was constructed for the

treatment of rinsewaters other than those containing chrome and cyanide. Chrome- and cyanide-containing wastewaters continued to be treated on a batch basis as described in Section 4.6.1.1 (E&E, 1981).

All treated wastewaters were routed to a clarifier which precipitated a heavy metals sludge. The sludge was pumped to two sludge drying beds or lagoons located east of Building 801 and the wastewater treatment plant (Wilson, 1972; E&E, 1981). The lagoons were connected to the wastewater treatment plant by a 2-inch PVC line running from the clarifier desludge pumps to the lagoons. The lagoons had a sludge storage capacity of 20,000 cubic feet (Wilson, 1972). The treated wastewaters were discharged into the storm sewer system and drained into the holding ponds located 0.6 miles west of Building 801 (E&E, 1981). The wastewater treatment plant's design capacity was 90 gallons per minute or 0.13 million gallons per day (mgd) (Wilson, 1972). Reported generation rates vary widely. According to one source, wastewater generated by the plant in 1971 was 600,000 gpd (average total daily amount discharged to the storm sewer) and 130,000 gpd of wastewater from plating operations alone were treated (HAC, 1972). The average dry weather flow in the early 1970s through the storm drain system was also reported as 281 gallons per minute during plant operations (Wilson, 1973). Another source reported that weekly treatment in 1971 was 1,250,000 gallons of dilute rinse waters, 10,000 gallons of concentrated chromic acid solutions, and 5,000 gallons of concentrated cyanide solutions (E&E, 1981). The average cyanide removal efficiency was reported in 1971 as 99.84 percent, with an influent concentration of 6 ppm. The average chrome removal efficiency was reported as 99.17 percent, with an influent concentration of 60 ppm and an effluent concentration of 0.05 ppm (HAC, 1972).

The following discussions provide an overview, by the generating shop, of process wastewater disposition during the early 1970s. All of the information is from a 1973 Water Pollution Control Study conducted at AFP 44 (Wilson, 1973).

Four wastewater drain and sump systems serving the Plating Shop were located on the east side of Building 801:

- A dilute chrome drain, which served all tanks containing chrome- or acid-bearing rinse waters
- A cyanide drain, which served all tanks containing concentrated and dilute cyanide-bearing wastewaters
- An acid drain, which served all tanks containing concentrated acid baths
- A storm drain, which collected all accidental spillage in the shop and served the alkaline cleaning tank and all tanks reported to contain chrome- and cyanide-free rinsewaters.

The first three drains emptied into their respective sumps located in the Plating Shop's basement, and were pumped to the appropriate holding tanks at the wastewater treatment facility to await treatment.

The Etch Circuitry Shop, also located on the east side of Building 801, had three wastewater collection systems:

- A chrome drain which served all tanks containing concentrated chrome- and acid-bearing waters
- A cyanide drain which served all tanks containing cyanide-bearing wastewaters
- A storm drain which served all alkaline cleaning tanks and tanks reported to contain chrome- or cyanide-free rinse waters.

The first two drains emptied into their respective sumps, which were pumped to holding tanks at the wastewater treatment plant to await treatment.

All wastewater from the Heat Treatment Shop was collected and pumped to the wastewater treatment plant. Wastewater consisted of vapor degreaser cooling water and overflow from rinse water tanks used to remove salt from parts.

The Welding Shop, then located in Building 830, had an aluminum deoxidizer tank which drained into a portable acid tank for treatment at the wastewater treatment facility. An alkaline cleaner tank drained directly into the sanitary sewer. Paint booth wash from the Painting Shop, also located in Building 830, flowed into the sanitary sewer.

Other various shops at the plant had aluminum deoxidizing tanks, which were pumped to the wastewater treatment plant, and alkaline cleaning tanks, which drained to a convenient storm or sanitary sewer connection.

Cooling tower and condensor blowdown water, generated both at the Main Air Conditioning Cooling Towers and throughout the facility, was discharged directly into the storm sewer system.

To summarize, the following wastewaters were treated at the plant's wastewater treatment facility during the early 1970s:

- Concentrated and dilute chrome-bearing wastewaters from the Plating and Etch Circuitry Shops
- Other acid-bearing waters, both concentrated and dilute, from the Plating and Etch Circuitry Shops
- Concentrated and dilute cyanide-bearing wastewaters from the Plating and Etch Circuitry Shops
- Vapor degreaser cooling water from the Heat Treatment Shop
- Salt-removal rinsewaters from the Heat Treatment Shop
- Waste acids from aluminum deoxidizer tanks from the Welding Shop and other general industrial shops.

The following process wastewaters were discharged to the storm or sanitary sewer system without requiring treatment at the wastewater treatment plant:

- Alkaline cleaning rinsewaters from the Plating Shop, Etch Circuitry Shop, Welding Shop, and other various shops

- Paint booth wash from the Painting Shop
- Cooling blowdown and condensate water from throughout the facility.

4.6.1.3 Zero-discharge Treatment - 1977 to Present

The zero-discharge wastewater treatment plant located west of Building 801 became operational in 1977. The final design of the facility was based on analyses of various alternatives which met or exceeded the requirements of local, state, and Federal regulations. The facility design was approved by the ASDH, the City of Tucson, the Department of Water and Sewers, and the U.S. EPA Region IX (HAC, 1980a). AFP 44 has submitted a RCRA Part B permit application for the facility; the RCRA Part A permit was submitted in 1980. The Part B permit application was submitted to the U.S. EPA, Region IX, in August 1983. The EPA's review resulted in a request for further information in July 1984. Revisions pursuant to this request were submitted to EPA, in December 1984, together with other revisions which reflected significant facility upgrades including the closure of sludge drying beds. The application and its revisions are being reviewed by the EPA (October 1985). The design capacity of the treatment plant is 530,000 gpd for general industrial wastewater (GIW) treatment, 12,000 gpd for chrome wastewater treatment, and 18,000 gpd for cyanide wastewater treatment. The facility's RCRA Part A permit (1980) estimated that an annual quantity of 308,000 gallons of wastewater treatment sludges were treated in tanks and 61,600 gallons of wastewater treatment sludges were stored in surface impoundments. An annual quantity of 1,138 gallons of spent cyanide plating bath solutions were both treated in tanks and stored in surface impoundments. In 1980, 1,250,000 gallons of dilute and 15,000 gallons of concentrated wastewaters were treated per week (HAC, 1980a).

The treatment method at the present wastewater plant is called zero-discharge because there is no surface discharge of treated waters from the facility. After wastewater treatment and solids removal, reclaimed water is returned for reuse in plant processes, and the sludges (removed solids) are evaporated to dryness in lined waste brine evaporation beds (HAC, 1980a; HAC, 1983; JRB, 1983). Approximately 75 to 80 percent of the treated wastewaters are reused at AFP 44 and the remaining 20 to 25 percent undergoes evaporation (JRB, 1983; HAC, 1980a).

The components of the zero-discharge facility include the following:

- A control building (Building 815) and filter building (Building 815-A)
- Six holding ponds, with a total of 15 cells
- A sludge thickener and press
- Five waste brine evaporation beds, with a total of 20 cells.

All surface impoundments are double lined with 100 ml high density polyethylene (HDPE). Three sludge drying beds were recently removed and replaced with the sludge press.

A percolation bed, which was located north of the sludge drying beds, was closed and filled. Other details on the surface impoundments are provided in Section 4.6.2, Waste Storage.

Wastewaters are segregated at collection and prior to treatment, according to the following categories:

- General Industrial Wastewaters (GIW), which include mixed rinsewaters, blowdown from the main cooling towers, condensate wastewater from the Building 801 fanhouse air handlers, and water-wash from paint booths
- Waste chromic and concentrated acid solutions
- Waste cyanide solutions.

General industrial wastewaters are collected from process areas, piped into the holding ponds, and then cycled through treatment (HAC, 1980a). The following major steps are used during treatment (HAC, 1983b; JRB, 1983):

1. Wastewaters are pretreated via the following:
    - flow measurement
    - grit removal
    - pH adjustment of acidic wastes through the addition of sodium hydroxide and pH adjustment of alkaline wastes through the addition of sulfuric acid, to reach a pH of 6.5.

2. Wastewaters flow to the reactor-clarifier where polymers are added and precipitated in the settling of colloidal solids.

3. Wastewaters flow to chromate reduction treatment in REDOX tanks where:

   - pH is reduced from 6.5 to 3.5 through the addition of sulfuric acid to maintain an acidic environment
   - hexavalent chromium is reduced chemically to trivalent chromium before the former forms an insoluble precipitate.

4. Wastewaters flow to the dissolved air flotation unit where:

   - sodium hydroxide is added to precipitate chromium, aluminum, and any residual heavy metals in two stages of precipitation
   - the precipitate settles to the bottom as a sludge, or rises to the surface with any oils and is removed by a skimmer
   - the sludge and skimmmings are pumped to the sludge press (formerly pumped to the drying beds).

5. The effluent flows to the filter wet well where:

   - two filtrations occur to reduce suspended solids
   - sulfuric acid is added to reduce the pH to 5.5
   - chlorine is added to provide a chlorine concentration.

6. Effluent enters the Reverse Osmosis (RO) wet well and is pumped through the RO unit for demineralization.

7. Permeate is pumped to a large fiberglass reservoir tank and lime is added to raise the pH from 5.5 to 8.0-8.5.

8. Treated effluent is discharged to the clear well for storage prior to reuse in plant processes.

9. Waste brine from the RO unit is discharged to the waste brine evaporation beds for solar evaporation.

In the first quarter of 1983, 184,000 tons of GIW were treated of which 147,200 tons were recycled and 36,800 tons were retained in the evaporation ponds. During the same quarter, 7.2 tons of precipitated sludges containing minor quantities of heavy metals were retained in the former sludge drying beds (HAC, 1983c). The precipitated sludges were held until disposal at a certified landfill (HAC, 1980a).

Waste chromic and concentrated acid solutions include all noncyanide, water-base solutions with a pH less than 7.0 and total dissolved solids at greater than 5,000 mg/l. Most of the concentrated acid solution volume is chromic acid. The solutions are pumped through their own underground collection system and undergo batch treatment, with each system consisting of a holding tank, transfer pump, treatment tank, recirculation pump, and chemical feed equipment (HAC, 1983b). The following major steps are performed in the treatment of these wastes (HAC, 1983b; JRB, 1983):

1. Wastewaters are collected and pumped to a holding tank
2. Wastewaters are transferred by pump to an adjacent treatment tank
3. Sulfur dioxide gas is added to recirculating wastewater to reduce hexavalent chromium to trivalent chromium under acidic conditions
4. Chromic ions are precipitated as metal hydroxide through the addition of liquid sodium hydroxide, which also neutralizes the solution
5. Treated effluent is pumped to the waste brine evaporation beds.

The design capacity of this system is 12,000 gallons per day. In 1983, 1,964,000 gallons of spent chrome plating solutions were generated at AFP 44. In the first quarter of 1983, 238 tons (64,000 gallons) of chromic wastes were treated (JRB, 1983; HAC, 1983c).

Waste cyanide solutions, both dilute and occasionally concentrated, are collected separately and pumped to the treatment plant. The major steps for the treatment of these wastes include the following (HAC, 1983b; JRB, 1983):

1. Wastewaters are collected and pumped to a holding tank
2. Waste is transferred to an adjacent treatment tank
3. Cyanide is oxidized to cyanate through the addition of chlorine at a pH of 10
4. Cyanate is oxidized to carbon dioxide and nitrogen gas through the addition of chlorine at a pH of 8, liquid sodium hydroxide is also added to maintain the pH
5. Effluent is discharged to the waste brine evaporation beds.

The design capacity of this system is 18,000 gallons per day (JRB, 1983). In 1983, 354,000 gallons of spent cyanide plating solutions were generated at AFP 44 (HAC, 1983b). In the first quarter of 1983, 44 tons (12,000 gallons) were treated (JRB, 1983; HAC, 1983c).

In August of 1984, a waste container triple-rinsing facility was implemented at the wastewater treatment plant. Earlier, the containers were rinsed outside of Building 801. The rinse water was collected by the general industrial wastewater system for treatment at the wastewater treatment plant.

4.6.2 Waste Storage

AFP 44 has stored hazardous wastes on-site since waste generation began in 1951. Storage methods have included drums, tanks, and surface impoundments. AFP 44 is currently an authorized hazardous waste storage facility for storage in surface impoundments associated with the wastewater treatment plant. Hazardous waste storage also occurs in 55-gallon drums and tanks, and is in all cases less than 90 days. Bulk storage of treated sludges occurs in a sludge press and brine evaporation ponds. Details of all waste storage operations, past and current, are provided below. Figure 4-5 illustrates the major locations of hazardous waste storage at AFP 44, and Table 4-7 describes the contents and capacities of waste storage tanks.

4.6.2.1 Drum Storage

Hazardous wastes historically stored in drums at AFP 44 include the following:

- Waste coolants
- Trichloroethylene
- Waste paint and paint sludges
- Methylene chloride
- 1,1,1-Trichloroethane
- Metallic mercury
- Paraformaldehyde
- Chromic acid mix, dry and compounds
- Methyl ethyl ketone

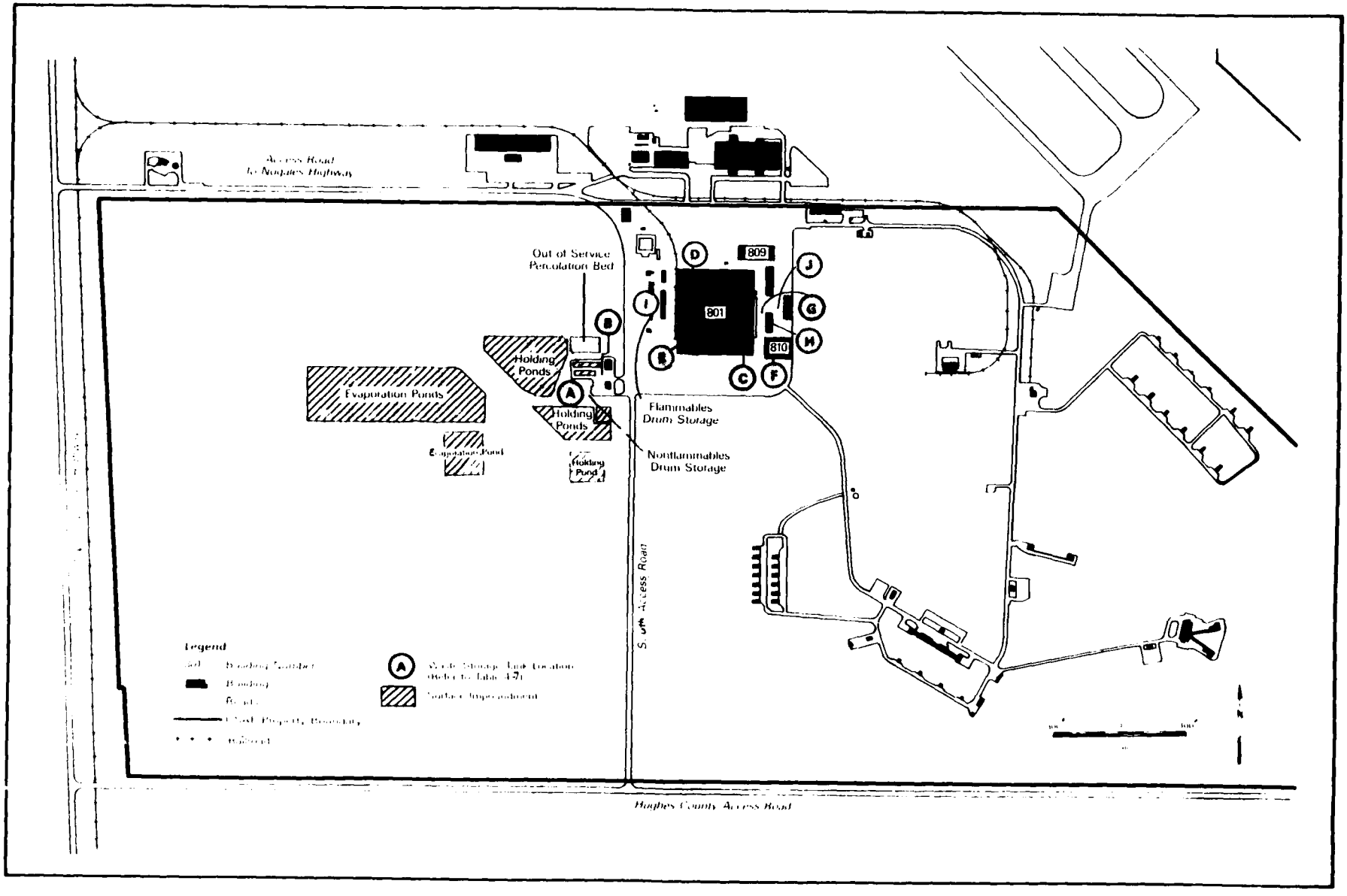


Figure 4-5. Locations of Waste Storage at AFP 44, Tucson, Arizona

Table 4-7. LISTING OF WASTE STORAGE TANKS AT AFP 44

Location (Figure 4-5)	Description of Location	Contents	Capacity (gallons)
A	Aboveground, Wastewater Treatment Plant	Acid holding tank	2,930
	Partially underground, Wastewater Treatment Plant	Cyanide alkaline holding tank	8,976
B	Aboveground, Wastewater Treatment Plant	Waste oil holding tank	5,875
C	Aboveground, Building 801	Cyanide sump	750
		Chromic acid sump	750
	Partially underground, Building 801	Chromic acid sump	750
		General industrial wastewaters sump	202
		Chromic acid sump	40
D	Aboveground, Building 801	Paint shop sump	1,044
		Paint shop sumps (two)	628 each
E	Aboveground, Building 801	Waste oil	997
		Wastewater soluble coolant	2,195

Table 4-7. LISTING OF WASTE STORAGE TANKS AT AFP 44 (Continued)

Location (Figure 4-5)	Description of Location	Contents	Capacity (gallons)
F	Aboveground, Building 810	Concentrated acid waste basin	733
		Alkaline basin	733
		General industrial waste-waters basin	733
G	Aboveground, outside west wall of Building 817	Waste stripper solution tank (glycol ether and ethanolamine in water)	3,000
		Waste 1,1,1-trichloroethane tank	3,000
H	Aboveground, outside southeast wall of Building 817	Spent ammoniacal etch tank (ammonium chloride, ammonia, and copper)	6,000
I	Aboveground, west of Building 833	Waste oil tank	997
J	Aboveground, outside west wall of Building 814	General industrial wastewater tank	785
		Concentrated acid waste tank	785
		Concentrated caustic waste tank	785

Source: HAC Facility Map, Existing Tank Locations, March 1984

- Toluene
- Stoddard solvents
- Mixed solvents, not otherwise specified (N.O.S.).

Prior to the cessation of on-site waste disposal, spent trichloroethylene and 1,1,1-trichloroethane from vapor degreasers located in Buildings 801 and 830 were pumped by maintenance into drums for disposal (Wilson, 1973). During this period, waste solvents were poured directly from the drums into on-site pits for disposal or use in fire training. Waste coolants were also stored in drums and disposed in the above manner prior to 1966. Beginning in approximately 1966, waste solvents were shipped off-site for recycling. This practice increased during the late 1960s and early 1970s.

Since 1976, all drummed wastes have been transported off-site by a contractor and disposed or reclaimed.

Mixed solvents used in general cleanup are placed in empty 5-gallon safety containers by the generating department. The containers are then placed in accumulation areas located throughout the plant. Full cans are picked up daily by the Materials Handling Department and are transferred to the flammable raw and waste materials storage area in Building 829, where the Chemical Storekeeper assumes custody. The Chemical Storekeeper is responsible for emptying solvents into new 55-gallon, red-colored drums for storage prior to off-site disposal (JRB, 1983). The drums are sampled, manifested, and labeled as "waste solvent, N.O.S." prior to off-site disposal. After 1966, and until TCE use at AFP 44 ceased, spent TCE was also stored on-site in drums prior to off-site reclamation.

Other wastes which have been recently or are currently stored in drums prior to their final off-site disposition include spent methylene chloride, waste paints, and paint sludges. Forklifts are used to transfer 55-gallon drums (containing solvents, coolants, paint sludges, etc.) from accumulation areas to storage areas (JRB, 1983). Drummed wastes are stored in two areas prior to off-site shipment. One storage area is a container management area in Building 815, which is designated as a storage area for drummed

nonflammables. The storage area for drums containing flammables is located within Building 829; and wastes in storage include methyl ethyl ketone, stoddard solvent, and toluene.

4.6.2.2 Tank Waste Storage

Wastes have been stored in tanks at AFP 44 for holding purposes prior to conveyance to, or treatment at, the wastewater treatment plant or prior to off-site disposal. Waste storage tanks and sumps are currently located throughout the plant including Building 801, the wastewater treatment plant, Building 810, Building 817, and Building 814. The following wastes have historically been stored or held in tanks and sumps at AFP 44:

- Acids, concentrated and dilute
- Cyanide solutions, concentrated and dilute
- Chrome solutions, concentrated and dilute
- Dilute general industrial wastewaters
- 1,1,1-Trichloroethane
- Water-soluble coolants (nonhazardous)
- Concentrated mineral oils
- Other waste oils
- Alkalines and caustics
- Waste stripper solution
- Spent ammoniacal etchant
- Aluminum deoxidizer (in tank cars).

Prior to operation of the current wastewater treatment plant, various sumps and holding tanks were used at Building 801 to hold process rinsewaters and both concentrated and dilute acids, chrome solutions, and cyanide solutions prior to their final disposition at the building's treatment plant; or prior to sewer discharge (Section 4.6.1 contains information on wastewater treatment history) (E&E, 1981; Wilson, 1973). In addition, the contents of aluminum deoxidizing tanks were pumped into tank cars and hauled to on-site treatment (Wilson, 1973).

Since about 1966, 1,1,1-trichloroethane from degreasers, water-soluble coolants from machining, and waste lubricating oils from machining have been stored in tanks. Waste trichloroethane is pumped directly from the degreaser to an aboveground tank at Building 817 prior to off-site reclamation (JRB, 1983). Coolant and mineral oils are accumulated and stored separately in aboveground tanks inside the west wall of Building 801 prior to their reclamation off-site (JRB, 1983).

The wastewater treatment plant and Building 801 have holding tanks and sumps for the storage of waste acids, including chromic acid solutions, cyanide solutions, and general industrial wastewaters prior to their on-site treatment (HAC, August, 1980; E&E, 1981). The waste cyanide tank at the wastewater treatment plant is partially below ground, open topped, and of concrete construction. This tank will be replaced in 1985 with an aboveground tank. The mixed acid storage tank is aboveground, closed topped, of steel construction, and diked.

The total capacity at AFP 44 for the storage of wastes in tanks is approximately 43,300 gallons. The capacity for tanks located partially underground is approximately 9,900 gallons. Waste storage tanks are not currently completely underground.

4.6.2.3 Surface Impoundment Storage

As noted earlier, AFP 44 is authorized for the storage of hazardous wastes in surface impoundments at the zero-discharge wastewater treatment plant.

There are currently one sludge thickener and press, six holding ponds, and five waste-brine evaporation beds at the plant. These surface impoundments are used for the storage of influent, treated effluent, and sludges. Prior to treatment, general industrial wastewaters may be pumped to the holding ponds which provide surge capacity. Following treatment, precipitated solids are pumped to the sludge press. Sludges are containerized and disposed off-site in a Class 1 landfill.

Three sludge drying beds were replaced this year by the sludge thickener and press. They were lined with two layers of 30 ml polyvinyl chloride (PVC) liners. Prior to the installation of these liners, the bottom of the sludge beds consisted of a layer of porous sand or pea gravel over an underdrain system, which collected the percolated sludge filtrate (HAC, March 1982). Liners were installed to protect the groundwater from any possible escape of filtrate from the drainage system (HAC, March 1982). The three sludge drying beds were removed prior to activation of the thickener and pursuant to a closure plan approved by the ADHS.

All existing surface impoundments are currently lined with two layers of 100 ml, high density polyethylene and are equipped with intermediate leak detection systems. Prior to this liner system, the ponds had a single 20 ml PVC liner. A foot of dirt now separates this liner from the current double liner system.

4.6.3 Waste Disposal

During the period 1952 to 1977, general industrial wastes and industrial wastewaters were disposed in a variety of ponds, pits, and drainage channels located on U.S. Government property. During previous investigations, historical disposal sites were either located in the field or interpreted from the review of site plan maps and aerial photographs. The following section summarizes the confirmed findings from previous studies regarding disposal locations and their sizes, periods of operation, and types of disposed waste. Table 4-8 summarizes AFP 44 waste disposal by waste type and historical disposal site.

Sufficient documentation exists to confirm the past disposal (prior to 1977) of hazardous substances at the following on-site locations:

- Former disposal trenches
- Former burn pit
- Former waste disposal pits
- Former wastewater ponds and sludge drying beds
- Drainage channels

TABLE 4-8. SUMMARY OF WASTE DISPOSAL HISTORY BY WASTE TYPE AND SITE AT AFP 44

Waste Type	Period of Waste Disposal by Site[1] (1952 – 1955 – 1962 – 1966 – 1972 – 1977[2])
Machining Coolants and Lubricants	Site 1; Site 2
Spent TCA, TCE, and Methylene Chloride	Site 1; Site 2; Site 3
Spent Solvents, N.O.S.	Site 1; Site 2; Site 3
Paint Sludges and Thinners	Site 1; Site 2; Site 3
Rinsewater, including Plating and Deburring	Site 1; Site 6 to Site 4
Acid Solutions, including Chromic	Site 6; Site 6 to Site 4; Site 5 and Site 6 to Site 4
Caustics	Site 6; Site 6 to Site 4
Cyanide Solutions	Site 6; Site 6 to Site 4; Site 5 and Site 6 to Site 4
WWTP Heavy Metal Sludge	Site 5
Alcohols	Site 7; Site 8
Flammable Solvents, including Acetone and MEK	Site 7; Site 7 & Site 10; Site 8

[1] Refer to Figure 4-7 for the locations at AFP 44 of the following sites:

Site 1 - Former Disposal Trenches
Site 2 - Former Disposal/Burn Pit
Site 3 - Former Disposal Pits
Site 4 - Former Wastewater Ponds
Site 5 - Former Sludge Drying Beds
Site 6 - Drainage Channels
Site 7 - North Fire Training Area
Site 8 - South Fire Training Area
Site 10 - West Fire Training Area

[2] After 1977 wastes were not disposed on AFP 44 property

- Fire training areas (three areas)
- Explosive pit.

The locations of the sites are illustrated in Figure 4-6. These sites are discussed further in the following sections; referenced site numbers are those given for the sites on Figure 4-6.

4.6.3.1 Former Disposal Trenches (Site 1)

During the period 1952 to 1955, two unlined trenches, located at the southern end of the plant property, were used together as a general disposal area. These trenches were approximately 10 feet deep, 150 feet long, and about 15 feet wide. Records were not retained pertaining to the exact types and quantities of wastes disposed at the site. However, the quantities of hazardous waste disposed were probably small because of the low production activity occurring at AFP 44 during pit usage and because wastes oils were being used for dust control. Additionally, excavation during the late 1970s to recover gold plated circuit boards from the trenches unearthed only nonhazardous trash. The trenches were graded and covered with surface soils natural to the area in 1955 (HMI, 1982a).

4.6.3.2 Former Burn Pit (Site 2)

In 1955, when the disposal trenches (Site 1) were no longer being used, a second area served as the general dump for industrial wastes. This second area was located in the southeast area of the plant property and consisted of a large unlined pit, approximately one-quarter acre in area and 6 or 7 feet deep.

From 1955 to 1966, this pit received liquid wastes consisting of flammable solvents, coolants and oil, and solids, including paint sludges, which were periodically burned. Approximately 7,000 gallons of flammable liquids, which included mixed liquids and diluted solvents, were disposed at the pit each week from 1955 to 1966. These liquids were burned off approximately four times weekly through 1963. Solid wastes were disposed and burned every night until 1963. After 1963, all burning activities at this site were permanently halted. From 1963 to 1966, disposal activities continued at the site.

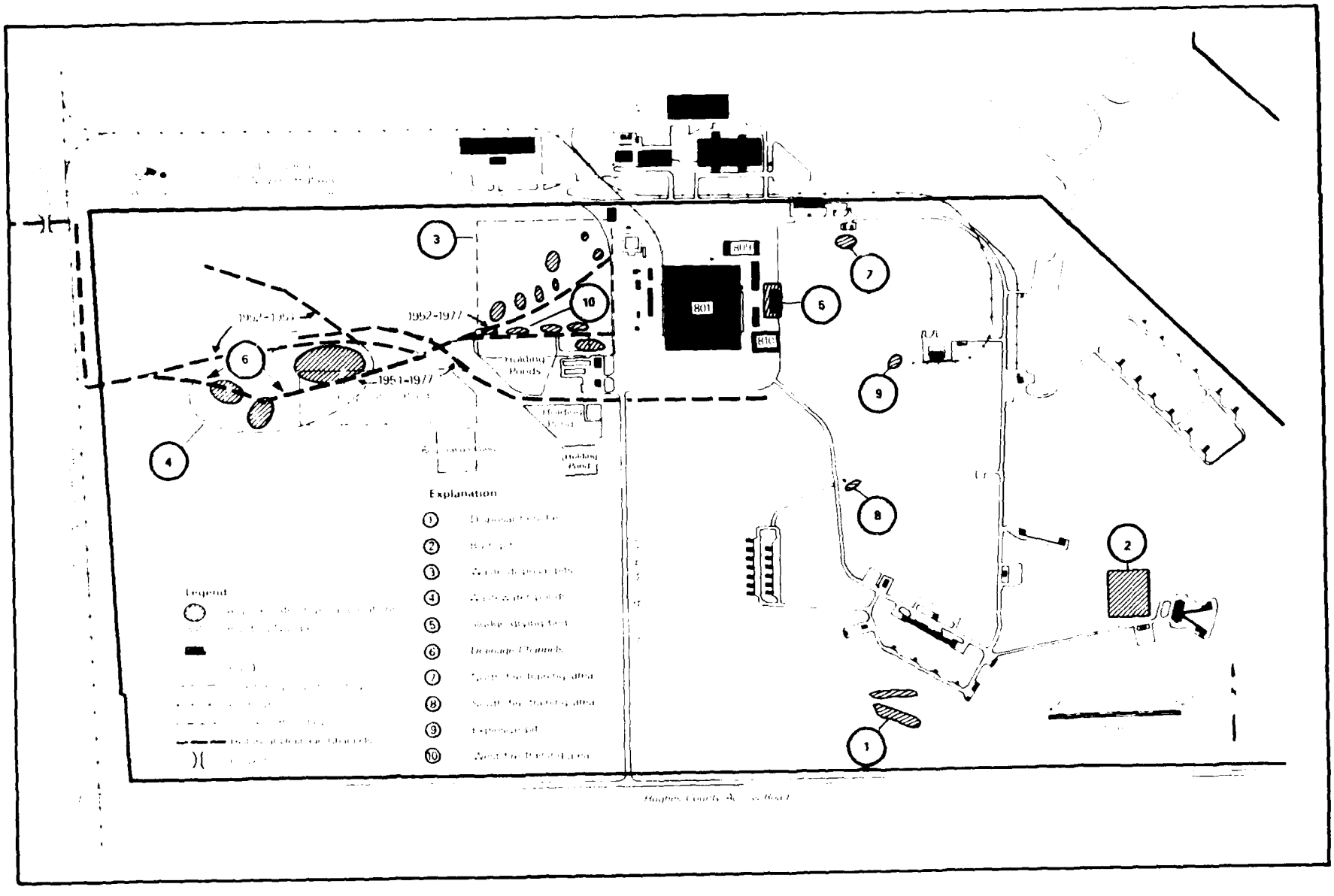


Figure 4-6. Past Disposal Locations at AFP 44, Tucson, Arizona

The use of this pit was discontinued altogether in 1966 when solid wastes were taken to a municipal landfill and solvents were disposed at Site 3. In 1980, a slightly domed cover of caliche was placed over its surface and seeded with shallow-rooted vegetation (HMI, 1982a).

4.6.3.3 Former Waste Disposal Pits (Site 3)

Site 3 comprised an area immediately west of Building 801 where there were numerous active, unlined, excavated pits. This area was used during the period 1966 to 1977 for the disposal of methylene chloride, 1,1,1-trichloroethane, trichloroethylene, other solvents, and paint sludges and thinners. Twelve former pits have been identified and are illustrated on Figure 4-6. The average diameter of these excavated disposal pits was approximately 8 to 10 feet.

4.6.3.4 Former Wastewater Ponds (Site 4) and Former Sludge Drying Beds (Site 5)

Three wastewater ponds and two sludge drying beds were utilized for disposal of industrial wastewater and sludge between the years 1954 and 1977. The three unlined ponds (Site 4) were located west of and beneath the existing evaporation ponds, and the two lined sludge drying beds were located just east of Building 801 (Site 5). Together, the ponds and drying beds covered an area of approximately 25 acres. Most of this area has now been paved over with a new asphalt parking lot.

The series of three ponds west of Building 801 were constructed in 1954 to eliminate any wastewater discharge toward the Santa Cruz River located to the west of AFP 44. These ponds were used for the disposal of wastewaters through 1977. The wastewaters consisted primarily of rinsewater from plating processes, cooling tower blowdown, and some concentrated solutions of chromium and cyanide (HMI, 1982a). Analytical results of wastewater samples indicated chromium concentrations of 0.05 ppm; cyanide was not detected. In 1980, the ponds were excavated, backfilled with clean fill, and domed and capped with caliche.

The two sludge drying beds along the east side of Building 801 were lined, one with a plastic membrane, and the other with bentonite. These beds were constructed in the early 1960s and received wastewaters (similar to that received by the three ponds to the west) and sludge from the wastewater treatment plant. The discharges contained chromium and cyanides, as well as traces of cadmium, silver, lead, and copper compounds. Precipitated heavy metal sludge was also pumped to these beds (HAC, 1980a). The two drying beds were utilized until 1977. They have since been excavated, backfilled with clean fill, and capped with caliche (HAC, 1980a). An asphalt concrete parking lot presently overlies the former bed locations.

From 1954 to 1970, AFP 44 personnel estimated that 1,250,000 gallons per week of rinsewater were disposed cumulatively in these ponds and beds. During this same period, approximately 15,000 gallons of effluent from the treatment of concentrated solutions, including chrome and cyanide, were reportedly disposed per week. From 1970 to 1977, approximately 20,000 gallons of rinsewater and 160 gallons of effluent from the treatment of concentrated solutions were disposed weekly (HAC, August 1980).

4.6.3.5 Drainage Channels (Site 6)

A system of open, unlined drainage channels transported industrial wastewaters west of Building 801 from 1952 to 1977. From 1952 to 1954, all waters entering this system discharged into the Arroyo Wash at the Nogales Highway. Ultimate discharge during periods of sufficient flow was the Santa Cruz River. In 1954, wastewater holding ponds were constructed to prevent off-site flow. The drainage channel system was rerouted toward the ponds. This eliminated the flow toward the Santa Cruz River. During storm periods, however, the ponds did overflow.

From 1952 through 1961, various types of wastewaters were discharged from the plant's wastewater treatment facility and shops into the drainage channels. Liquids discharged included chrome- and cyanide-free rinsewaters, acid solutions after batch treatment, and batch treated chrome- and cyanide-containing wastewaters.

Rinsewaters from the general factory area and the Heat Treatment Shop were discharged directly to the storm system through floor drains. This practice was discontinued in 1957 when these discharges were rerouted to the treatment facility. During the late 1950s, approximately 400,000 gallons per day (gpd) in total were reportedly discharged to the drainage channel system. A water conservation program at the plant reduced the flow to 130,000 gpd.

From 1962 to 1977, the only untreated liquid wastes that entered the channels were alkaline cleaning and chrome- and cyanide-free rinsewaters from the Plating Shop, Etch Circuitry Shop, Welding Shop, and a few others; paint booth wash from the Paint Shop; accidental spillage and accidental process tank overflows; and cooling blowdown and condensate from throughout the plant. All other wastewaters were initially treated.

From 1977 to the present, a zero-discharge wastewater treatment plant has been utilized, and drainage channels have not been used for wastewater discharge. The channels are apparent on aerial photographs of the plant area for the period 1956 to 1976. Phreatophytic vegetation had developed along and adjacent to the channels and wastewater disposal ponds during channel use, and appear as dark areas on historical photographs (HMI, 1982a).

4.6.3.6 North Fire Training Area (Site 7)

The fire training area located in the northeast area of the plant property was used during the 1950s. The site occupied a diked area of approximately one-quarter acre. Fire training exercises were conducted approximately three times a week for one month per year (i.e., 12 times a year), using alcohols and flammable solvents including acetone and methyl ethyl ketone (MEK). Generally, during each session, two 55-gallon drums containing these wastes were emptied onto the ground, ignited, then extinguished using CO_2 powder. During similar training sessions, solvent fires were also extinguished using water. In addition to solvent fire training, sessions were also held involving metal and wood burning fires.

4.6.3.7 South Fire Training Area (Site 8)

The southern-most fire training area was located at the base of a water tower. This site was used for 2 or 3 years during the early 1960s. The training sessions conducted at this location involved flow fires in which flammable fluids were discharged from a 150-gallon tank down a sloped tile drainageway into a trough. The discharged substances were subsequently ignited to create a fire blaze. A firetruck was used to extinguish the fires, using water as the extinguishing agent. The fluids discharged from the tank included alcohols, acetone, MEK, and mixed flammable solvents. These exercises were conducted 3 to 5 times per year. The total quantity of material used during these sessions did not exceed 150 gallons. Metal and wood fires were also created for training sessions conducted at this site.

4.6.3.8 Explosive Pit (Site 9)

Site 9 was used for the detonation of ordnance materials and was located in the eastern area of the plant property between Sites 7 and 8. Detailed information regarding the use of this site is not available, except that materials disposed were not hazardous in nature.

4.6.3.9 West Fire Training Area (Site 10)

During the late 1950s, a third fire training area was utilized at AFP 44. This site was located in a ditch along a roadway, and is partially overlain by AFP 44's existing wastewater holding ponds. On a weekly basis, during two months per year, small contained fires were ignited at the site using less than 5 gallons of flammable solvents for each occurrence. Personnel were trained in the proper use of fire extinguishers. Water was also used to extinguish the fires. The site has since been covered with caliche.

4.6.4 Used Container Management

Since August of 1984, used waste containers have been rinsed at the wastewater treatment plant before container reuse or disposal. The containers are rinsed three times and the rinsewater is treated at the facility Empty raw material drums are either returned to vendors or disposed at an off-site landfill.

Prior to activation of the container triple rinsing facility and starting in 1977, the containers were rinsed on a concrete pad outside of Building 801. The rinsewater went through the general industrial wastewater collection system and was routed to the wastewater treatment plant. Between 1966 and 1977, empty and rinsed containers were sent directly to an off-site sanitary landfill. Prior to 1966, used containers, which had contained heavy metals, trichloroethylene, 1,1,1-trichloroethane, and other solvents, were disposed on-site in pits.

4.6.5 Used Oil Management and Dust Control

Currently, waste lubricating oils generated at AFP 44 are collected by a mobile collector and transported to an aboveground bunker at Building 801. These oils are collected by a contractor for off-site recycling.

Waste coolants, lubricating oils, and hydraulic oils were used for dust control at AFP 44 in accordance with established practices of the period. The approximate period during which this activity occurred is from the middle 1950s to the middle 1960s. The approximate location of the activity is directly south of Building 830 in an area as wide as Building 830 and about 400 feet long. Much of the area is now covered by a structure and parking lot.

4.6.6 PCB Management

Hughes has numerous PCB capacitors and transformers in use. PCB equipment maintenance is the responsibility of the Facilities Engineering Electrical Department. Inspections are performed jointly by the Electrical and Safety Departments. An inventory completed in 1981 catalogued 3 capacitors and 44 transformers with total quantities of 3.1 gallons and 10,946 gallons of PCB oils, respectively. Individual capacitor capacities range from 0.6 gallons to 1.9 gallons. Capacities for transformers range from 110 gallons to 294 gallons. Capacitors and transformers are located predominantly throughout and on the roof of Building 801, but are also located on and off U.S. Government property in Buildings 802, 803, 815, 833, 836, 852, and 864 (JRB, 1983).

Most in-service PCB capacitors and transformers are reportedly placed in unlocked metal buildings on concrete floors with perimeter curbing. Some are outside buildings on non-curbed concrete pads. All equipment is labeled with required PCB markings. Inspections are performed monthly to identify problems. Routine preventive maintenance is performed on an annual basis. As a precautionary measure, all drain valves are equipped with a metal box filled with absorbents into which any slow dripping oils may collect (JRB, 1983).

Hughes only stores waste PCBs and out-of-service PCB equipment on an interim basis (i.e., for 1 to 2 weeks). Storage is restricted to a locked, curbed vault. PCB wastes are sent off-site for disposal. The last shipment was in 1984 and consisted of the removal of four transformers from Building 840.

4.6.7 Storm Sewer System

The storm sewer system at AFP 44 consists of a drainage line and a network of drainage channels originally constructed to convey waters from the plant to a natural drainage wash located approximately one-half mile west of Building 801 (HAC, 1958; E&E, 1981). This wash drained westerly to the Nogales Highway and the Santa Cruz River (HAC, 1958; OCE-AF, 1959). As described in Section 4.6.1, Industrial Wastewater Treatment, the 30-inch storm drainage line, located north of Building 801 and extending approximately 1200 feet west, was used to carry wastewaters to the drainage channel system. These operations are also described in Sections 4.1, Industrial Shops, and 4.6.3, Waste Disposal. Figure 3-2 in Section 3 illustrates the location of the storm sewer and drainage channel system.

4.6.8 Sanitary Sewer System

As described in Section 3, sanitary wastes are collected by the plant's sanitary sewer system and discharged into the City of Tucson sanitary sewer. Although industrial wastes are currently segregated and are never discharged into the sanitary sewer system, such discharges occurred in the past, including alkaline rinsewaters and paint booth wash (Wilson, 1973).

4.7 EVALUATION OF ACTIVITIES

The review of past operations at AFP 44 has resulted in the identification of thirteen sites which were initially considered to have the potential for environmental contamination or contaminant migration as shown in Table 4-9. Figure 4-7 identifies the location of the sites. These sites were evaluated using the methodology illustrated in Figure 1-2. Two sites were finally considered not to have both the potential for contamination and migration and were thus deleted from further consideration. These two sites include: Site 9 - an explosive pit located west of Building 866 that was used for the detonation of ordnance materials which were not hazardous in nature; and Site 11 - the location of a gasoline storage tank that was removed. The tank removal operations included testing and excavation of contaminated soils so that the contaminant source was removed. These sites were not deemed to pose significant environmental threats.

The remaining eleven sites were further evaluated using the Hazard Assessment Rating Methodology (HARM). The results of the HARM as applied to the evaluated sites are summarized in Table 4-10. The rating methodology and score sheets are provided in Appendices E and F, respectively.

For the purpose of HARM scoring, direct evidence for the migration of hazardous contaminants (pathways subscore) was, for most of the rated sites, the groundwater contamination known to exist in the area based on laboratory analyses. This evidence would not have been available for site rating without the documentation compiled by studies conducted since 1980 by various public and private entities, including documentation compiled for other ongoing phases of the IRP at AFP 44. These environmental and hydrogeologic investigations were conducted on and around AFP 44 to comprehensively determine the extent and nature of environmental contamination (i.e., groundwater contamination). A plan for contaminant control and remedial action implementation has been published (October 1985) for public review and comment. This plan will be executed once it is finally approved or revised. Also, two of the ranked sites, Sites 4 and 5, have received remedial action in the form of excavation, backfilling, and capping with caliche.

Table 4-9. SUMMARY OF DECISION LOGIC FOR RATING AREAS OF POTENTIAL ENVIRONMENTAL CONCERN AT AFP 44

Site Number (Figure 4-7) and Description	Potential for Environmental Contamination	Potential for Migration	Potential for Other Environmental Concern	HARM Rating
1. Former Disposal Trenches, Southeastern Border of AFP 44	Yes	Yes	No	Yes
2. Former Burn Pit, Southeast Quadrant of AFP 44	Yes	Yes	No	Yes
3. Former Waste Disposal Pits, West of Building 801	Yes	Yes	No	Yes
4. Former Wastewater Ponds, Beneath Existing Evaporation Ponds at Wastewater Treatment Plant and West of Building 801	Yes	Yes	No	Yes
5. Former Sludge Drying Beds, East of Building 801	Yes	Yes	No	Yes
6. Drainage Channels, West of Building 801	Yes	Yes	No	Yes
7. North Fire Training Area, Southeast of Building 830	Yes	Yes	No	Yes
8. South Fire Training Area, at Base of FACO Water Tower	Yes	Yes	No	Yes
9. Explosive Pit, West of Building 866	No	Yes	No	No

Table 4-9. SUMMARY OF DECISION LOGIC FOR RATING AREAS OF POTENTIAL ENVIRONMENTAL CONCERN AT AFP 44 (Continued)

Site Number (Figure 4-7) and Description	Potential for Environmental Contamination	Potential for Migration	Potential for Other Environmental Concern	HARM Rating
10. West Fire Training Area, West of Building 801	Yes	Yes	No	Yes
11. Removed Gasoline Storage Tanks, West of Building 833	No	Yes	No	No
12. Diesel Fuel Tank, Between Buildings 801 and 810	Yes	Yes	No	Yes
13. Waste Oil Spreading Site, South of Building 830	Yes	Yes	No	Yes

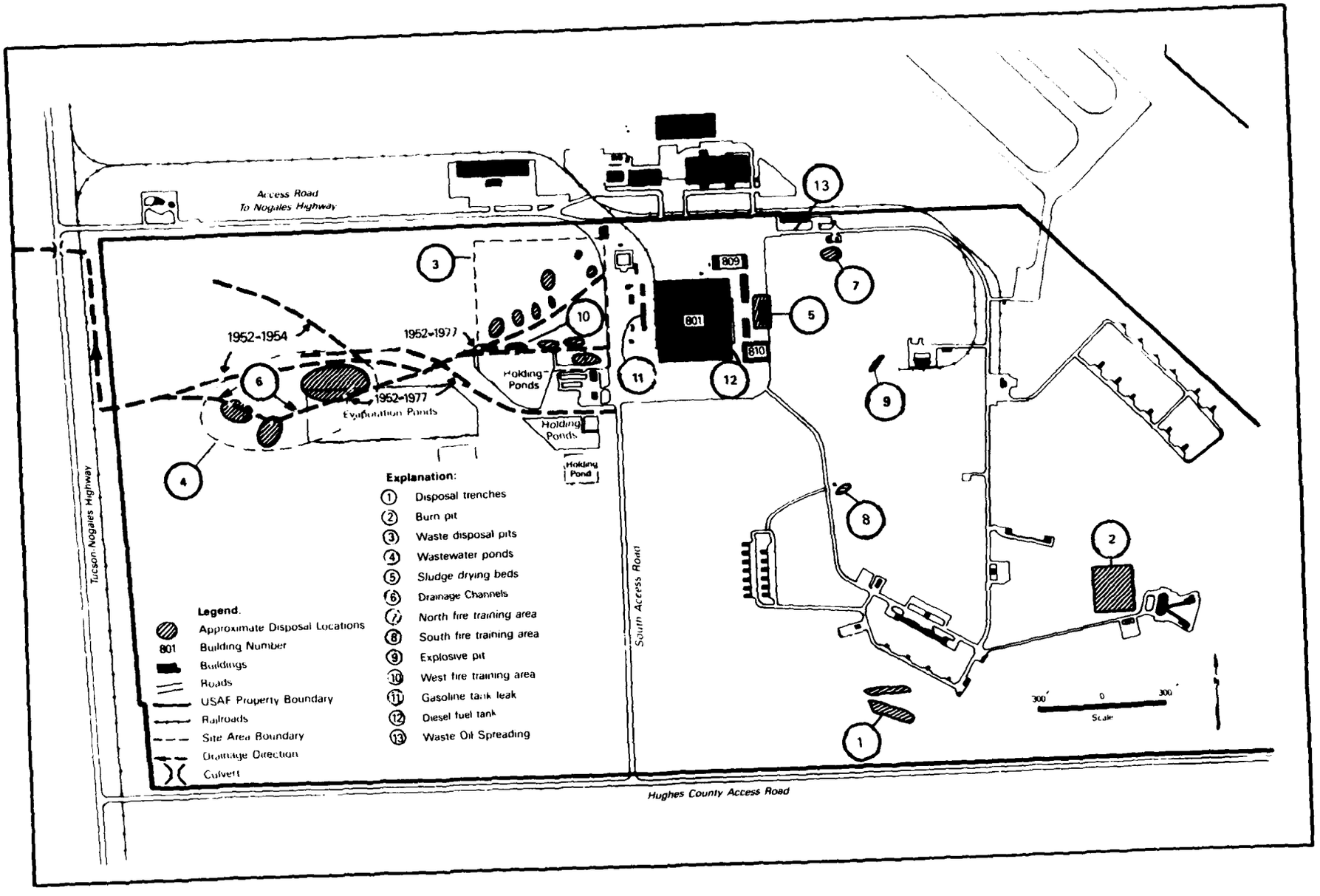


Figure 4-7. Location of Sites with Potential for Environmental Contamination or Contaminant Migration, AFP 44, Tucson, Arizona

Table 4-10. SUMMARY OF HARM SCORES AND RATINGS FOR IDENTIFIED SITES

Rank	Site Description	Receptors	Waste Character-istics	Pathways	Overall HARM[2] Rating
1	Former Waste Disposal Pits (Site 3)	55	100	100	85
2	Former Wastewater Ponds (Site 4)	53	100	100	84
3	Former Burn/Disposal Pit (Site 2)	46	100	100	82
4	Former Sludge Drying Beds (Site 5)	49	100	100	79
5	Drainage Channels (Site 6)	59	100	43	67
6	Former Disposal Trenches (Site 1)	55	40	100	65
7	North Fire Training Area (Site 7)	55	80	43	56
8	Diesel Fuel Tank (Site 12)	55	32	80	56
9	South Fire Training Area (Site 8)	52	80	35	53
10	Waste Oil Spreading (Site 13)	55	64	43	51
11	West Fire Training Area (Site 10)	55	60	43	50

[2] Air Force Hazard Assessment Rating Methodology, maximum of 100 points possible.

5.0 CONCLUSIONS

The objective of this investigation was to review and assess information regarding past practices at AFP 44, and prepare a comprehensive Phase I report in the USAF IRP prescribed format. Information contained in this report was obtained during the Phase I site visit and from documents compiled during other investigations conducted by public and private entities. Identified past disposal sites were rated using the IRP Hazard Assessment Rating Methdology (HARM). The conclusions presented below have been developed based on information from the Phase I site visit, retired AF records, interviews, and documents compiled as a result of recent hydrogeologic investigations. The conclusions are listed by the sites identified on U. S. Government property and evaluated by the HARM. Hazardous waste management occurring off the U. S. Government property is not addressed.

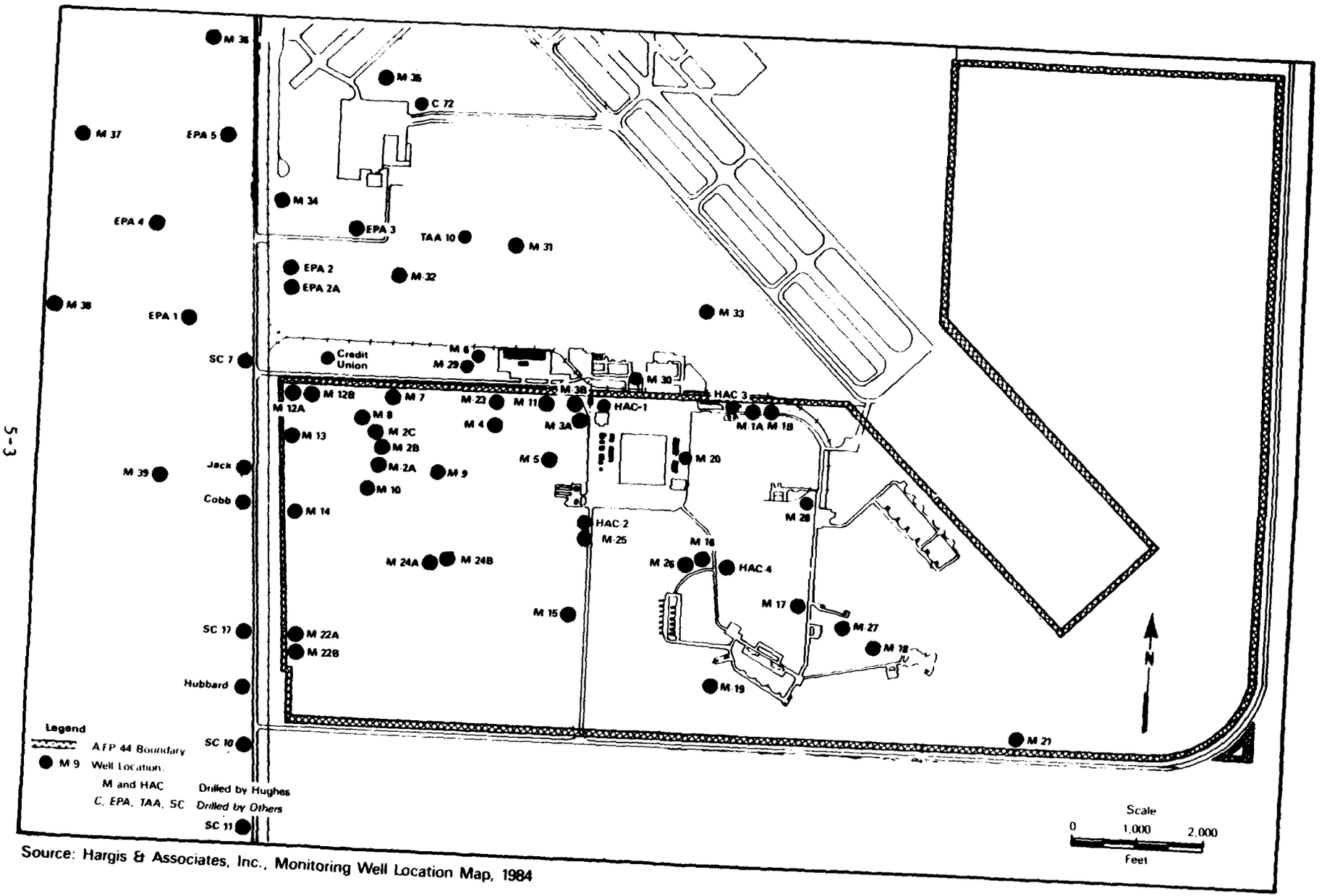
The hydrogeologic setting at the hazardous waste management sites identified on U. S. Government property is characterized by alluvial sediments consisting of silts, sands, and gravels, and an aquifer system (comprised of an upper and lower zone) which is regionally classified as a sole source aquifer. Groundwater levels in the area occur at depths between 100 and 140 feet below the land surface. Contaminants that reach the aquifer will be transported in the groundwater. Data indicate that groundwater moves at about 500 feet per year in the vicinity of AFP 44. Long term aquifer tests at AFP 44 indicate transmissivity ranges from about 25,000 to 50,000 gallons per day per foot. Both surface water drainage and groundwater movement are in a northwesterly direction toward the Santa Cruz River. The overall hydrogeologic setting of the AFP 44 area, together with documented evidence of contaminant migration, present a potential for environmental contamination to exist in the vicinity of past waste management sites at AFP 44.

Intensive hydrogeologic investigations and monitoring have taken place at and around the facility. Hargis & Montgomery, Inc. (later Hargis & Associates, Inc.), under contract to Hughes and subsequently to the Air Force,

have installed over 100 monitoring locations on or in the vicinity of AFP 44 in order to determine the magnitude of contamination resulting from past disposal practices. Locations of selected monitoring locations are shown in Figure 5-1. In addition, numerous soil samples and exploratory borings have also been taken to aid in the evaluation. Sampling performed to date has allowed for the establishment of background groundwater quality, identification of disposal sites which contributed to the contamination problems, and delineation of the area of groundwater contamination at AFP 44.

Table 5-1 summarizes the findings of this Phase I study and lists the priority rankings for the 11 identified sites. The identified sites were rated using site conditions as existed when the sites were actively accepting wastes. For the purpose of HARM scoring, direct evidence for the migration of hazardous contaminants (HARM pathways subscore) was, for most of the rated sites, the groundwater contamination known to exist in the area based on the sampling activities performed to date. This data would not have been available otherwise without the prior site investigations performed by various entities and documentation compiled for other ongoing phases of the IRP at AFP 44. As also noted earlier, a plan for contaminant control and remedial action implementation has been published for public review and comment. This plan will be executed once it is final. Additionally, two of the ranked sites, Sites 4 and 5, have received remedial action in the form of excavation, backfilling, and capping. HARM rating forms for the sites are included in Appendix F.

The evaluated sites are discussed below in order of highest to lowest priority ranking. Site numbers provided in parentheses in the section headings below correspond to the site numbers listed on Figure 4-7, which illustrated the approximate site locations.



Source: Hargis & Associates, Inc., Monitoring Well Location Map, 1984

Figure 5-1. Monitoring Well Locations at AFP 44, Tucson, Arizona

Table 5-1. SUMMARY OF SITES WITH POTENTIAL FOR ENVIRONMENTAL CONTAMINATION

Rank	Site Name	HARM Score	Period of Occurrence	Activity	Evidence of Contamination
1	Former Waste Disposal Pits (Site 3)	85	1966 to 1977	Disposal of solvents, paint sludges, and paint thinners	DCE and TCE concentrations found in perched groundwater zone and upper and lower zones of regional aquifer
2	Former Wastewater Ponds, West of Building 801 (Site 4)	84	1952 to 1977	Disposal of process wastewaters	TCA, TCE, DCE, toluene, and bis (2-ethylhexyl) phthalate in both perched zone and upper zone of regional aquifer
3	Former Burn/Disposal Pit (Site 2)	82	1955 to 1966	Disposal and burning of flammable liquids and solids	TCE concentrations detected northwest of site in upper groundwater zone
4	Former Sludge Drying Beds, East of Building 801 (Site 5)	79	1960s to 1977	Disposal of process wastewaters and sludges from wastewater treatment	Chromium, TCE, and DCE detected in upper groundwater zone

Table 5-1. SUMMARY OF SITES WITH POTENTIAL FOR ENVIRONMENTAL CONTAMINATION (continued)

Rank	Site Name	HARM Score	Period of Occurrence	Activity	Evidence of Contamination
5	Drainage Channels (Site 6)	67	1952 to 1977	Disposal of process waste-waters	Evidence cannot directly confirm that this site is a source of contamination because the total site area is so spread-out. However, contaminant concentrations have been detected in perched groundwater and in the regional aquifer in the vicinity of the channels
6	Former Disposal Trenches (Site 1)	65	1952 to 1955	Primarily disposal of nonhazardous trash with limited amounts of hazardous wastes such as solvents, paints, sludges, and other chemicals	TCE concentrations found in upper zone of regional aquifer in site vicinity
7	North Fire Training Area (Site 7)	56	Middle to late 1950s	Burning of flammable solvents	Neither direct nor indirect evidence of contamination exists

Table 5-1. SUMMARY OF SITES WITH POTENTIAL FOR ENVIRONMENTAL CONTAMINATION (continued)

Rank	Site Name	HARM Score	Period of Occurrence	Activity	Evidence of Contamination
8	Diesel Fuel Tank, Between Buildings 801 and 810 (Site 12)	56	Start date unknown, present occurrence suspected	Underground storage of diesel fuel	Failure to pass pressure test
9	South Fire Training Area (Site 8)	53	Early 1960s	Flow fires using flammable fluids	Neither direct nor indirect evidence of contamination exists
10	Waste Oil Spreading (Site 13)	51	Middle 1950s to middle 1960s	Land spreading of waste oils for dust control	Neither direct nor indirect evidence of contamination exists
11	West Fire Training Area (Site 10)	50	Late 1950s	Small fires of flammable solvents	Neither direct nor indirect evidence of contamination exists

5.1 FORMER WASTE DISPOSAL PITS (SITE 3)

Twelve unlined pits located west of Building 801 were used between 1966 and 1977 for the disposal of various hazardous wastes. Wastes reported to have been disposed in the pits include methylene chloride, 1,1,1-trichloroethane, trichloroethylene, solvents, and paint sludges and thinners.

The disposal pits were given the highest overall HARM score of 85 because they received both a comparatively high receptor subscore and maximum subscores for waste characteristics and pathways.

The site has been covered with caliche, which will limit the flux of water percolating through the pits, and has not received liquid wastes since 1977. Therefore, the disposal pits should not be a source of continued contamination. Monitoring data for wells located within the area (i.e., wells M-5, M-3A, and M-11) have shown a decrease in contaminant levels for TCE, TCA, and DCA since 1981.

5.2 FORMER WASTEWATER PONDS (SITE 4)

Three unlined ponds were located west of Building 801 and beneath the existing evaporation ponds at the wastewater treatment plant. These ponds were constructed in 1954 to eliminate the rate of flow from the drainage channels. These ponds were used for the disposal of process wastewaters through 1977. Wastewaters reported to be disposed in these ponds included plating rinsewaters, cooling tower blowdown water, and treated solutions of chromium and cyanide.

This site received a high overall HARM score of 84 because it had a comparatively high receptor subscore and maximum subscores for waste characteristics and pathways.

The contaminated materials have been excavated and the site was backfilled with clean fill and capped with caliche in 1980. The ponds are probably not a continuing source of contaminants because of the remedial action performed and because waste disposal has not occurred since 1977. This

statement is supported by downgradient monitoring at the site which has shown that contaminant levels are not increasing.

5.3 FORMER BURN PIT (SITE 2)

A large, unlined pit located on the southeast area of AFP 44 was used beginning in 1955 as a general dump site for industrial wastes. The pit was approximately one-quarter of an acre in size. The pit was reportedly used for the disposal of solvents, coolants, oils, paint sludges, and other solids. Burning of wastes occurred at the site until 1963 and waste disposal continued until 1966.

This site was assigned a relatively high HARM score of 82 because it received the maximum subscores for waste characteristics and pathways. However, the site was capped with caliche and seeded in 1980, which should protect against surface water infiltration.

5.4 FORMER SLUDGE DRYING BEDS (SITE 5)

Two sludge drying beds were constructed on the east side of Building 801 and received sludge and limited amounts of wastewater from the batch and flow-through wastewater treatment facility. Both drying beds were at some point lined, one with a plastic membrane and the other with bentonite. They were in use until 1977 when the zero-discharge wastewater treatment plant was placed on-line.

The drying beds received an overall HARM score of 79 with maximum waste characteristics and pathway subscores. The overall score is lower than the above sites because some limited containment was provided by the liners.

The beds have been excavated and capped with caliche, and covered with an asphalt concrete parking lot. The remedial actions performed at the site should have removed the source of contamination. Groundwater monitoring downgradient of the site has shown an increase in contaminant concentrations, however, this is probably attributable to contaminant migration from other areas.

5.5 DRAINAGE CHANNELS (SITE 6)

A network of drainage channels west of Building 801 were used at AFP 44 until 1977 for the disposal of various treated and untreated process wastewaters. These channels drained to the west toward Nogales Highway. From 1952 to 1954, all waters entering the channels discharged into the Arroyo Wash at the Nogales Highway. In 1954, wastewater holding ponds (Site 4) were constructed and the drainage channel system was rerouted toward the ponds to prevent off-site flow. The channels have not been used for wastewater disposal since 1977, when the zero-discharge wastewater treatment plant became operational.

The channels were assigned an overall HARM rating of 67 because of receiving low receptors and pathway subscores, but a high waste characteristics subscore.

Remedial actions have not taken place at the site. However, wastes are no longer disposed in the channels and any contaminants should be residuals from previous disposal activities.

5.6 FORMER DISPOSAL TRENCHES (SITE 1)

Two unlined trenches, located on the southern boundary of AFP 44, were used as a general disposal area until 1955. Wastes disposed primarily included nonhazardous trash with limited amounts of hazardous waste such as solvents, paints, and sludges. These trenches have since been graded and covered with native soils.

The trenches received an overall HARM score of 65. The score is lower than for the above sites because the site received a lower waste characteristics subscore.

5.7 NORTH FIRE TRAINING AREA (SITE 7)

Fire training occurred southeast of Building 830 between the middle 1950s to late 1950s. The site was active approximately 12 times a year and primarily involved the burning of flammable solvents.

The area was given an overall HARM score of 56, lower than the above sites because of a lower pathway subscore. The site is probably no longer a source of contamination because liquid disposal was halted in the late 1950s and net infiltration through the site is very small.

5.8 DIESEL FUEL TANK (SITE 12)

An underground, 10,000 gallon, diesel fuel storage tank was pressure tested in 1984 and did not pass the test. Therefore, leakage should be suspected until tank excavation proves otherwise. The tank is Tank No. 38 located between Buildings 801 and 810.

The tank site received an overall HARM score of 56, which is lower than the above sites mainly because of a lower quantity of waste. The tank is scheduled for removal in the near future. If the tank is found to be leaking, any contaminated soils will be excavated to remove the potential for environmental contamination.

5.9 SOUTH FIRE TRAINING AREA (SITE 8)

An area located at the base of the FACO Water Tower was used for flow fire training exercises for several years in the early 1960s. Flammable fluids were discharged from a tank onto a tile-lined drainageway.

This site received an overall HARM rating of 53, lower than the previous sites mainly because of a lower pathway subscore. Remedial actions have not been performed at the site; however, the site has not received hazardous materials for over 20 years and is probably no longer a source of contamination. Groundwater monitoring downgradient of the site has shown increased contaminant levels, but these increases are most likely the result of upgradient influences.

5.10 WASTE OIL SPREADING (SITE 13)

From the middle 1950s through the middle 1960s, waste machining lubricants were used on-site as dust suppressants. The approximate location of this activity was directly south of Building 830 in an area as wide as Building 830 and about 400 feet long.

The waste oil spreading site received a HARM score of 51, lower than the previous sites because of lower waste characteristics and pathway subscores. Most of the area is now covered with a building and parking lot.

5.11 WEST FIRE TRAINING AREA (SITE 10)

The west fire training site was located on a roadway along a ditch west of Building 801. Training demonstrations were given to AFP 44 personnel in the use of fire extinguishers at this site during the late 1950s. The fires were small, involving less than 5 gallons of flammable solvents each time.

This site received an overall HARM score of 50, less than those sites above primarily because it received lower waste characteristics and pathway subscores. The site was capped with caliche which should reduce surface water infiltration. The site is probably no longer a contaminant source since liquid wastes have not been disposed at the site for over 30 years and net infiltration is nearly zero.

6.0 RECOMMENDATIONS

The intensive hydrogeologic investigations performed at and around AFP 44 by Hargis & Montgomery, Inc. (later Hargis & Associates, Inc.) are considered sufficient by the Phase I team to constitute an IRP Phase II effort. The data acquired to date has allowed for the determination of the extent and magnitude of contamination resulting from past waste disposal activities and for the selection of an appropriate remedial action under Phase IV. Therefore, further Phase II investigations are not recommended at this time. However, the following actions are recommended:

- Implementation of the Remedial Action. Remedial action should be implemented as soon as possible, after approval, to mitigate the further spread of contaminants.

- Continuation of Environmental Monitoring. Phase II environmental monitoring should be continued at AFP 44 during the performance of the remedial action to assess its effectiveness and to ensure that potential contaminant sources are no longer leaking.

- Removal of Underground Tanks. The proposed underground tank removal program should be accelerated so that any remaining underground tanks are removed as soon as possible. If any tank is found to be leaking, tank removal should be followed by soil boring to determine the extent of contamination. Contaminated soil surrounding the tank should be excavated, the excavation should be backfilled with clean soils, and an impermeable cap should be emplaced to ensure that the site is not a source of contaminants in the future.

- Waste Oil Spreading Site. Soils in the area of Site 13 should be sampled and analyzed for PCBs. This should be done only as a precautionary measure, since the records search did not reveal any evidence that PCB-containing oils were disposed in this area.

- Sealing of Wells. Any well that is screened in both the upper and lower zones of the regional aquifer and is in the path of an area of groundwater contamination should be sealed to prevent cross-contamination between the aquifer zones. Sealing should be performed by overdrilling the well, removal of the well and well construction material, and sealing the hole with a bentonite slurry.

APPENDIX A

PHASE I INVESTIGATION TEAM BIOGRAPHICAL DATA

JENNIFER A. BRAMLETT

EDUCATION

University of Maryland: B.S., Natural Resource Management (1979)

EXPERIENCE

Ms. Bramlett is an environmental scientist with over five years of experience in the field of solid and hazardous waste management. She has worked within waste regulatory programs under both RCRA and CERCLA, for both the U.S. EPA and the Department of Defense (DOD) and for state and local governments.

Ms. Bramlett is currently the Task Manager for an installation assessment of a government-owned, contractor-operated (GOCO) facility in Tucson, Arizona. This is a Phase I effort under the Air Force's Installation Restoration Program (IRP). The objectives of the IRP are to comprehensively identify and evaluate hazardous waste sites on DOD installations and to implement actions to control any contaminant migration. Phase I of the IRP primary involves the documentation of past and present industrial operations and on-site waste management practices. Ms. Bramlett was also a major technical contributor during a Phase I effort at a GOCO facility in San Diego, CA and assisted in the completion of a Phase II effort for a DOD facility in Delaware.

Ms. Bramlett was also a Team Leader during a preliminary assessment, for the DOD, of waste resource conservation and recovery opportunities at eleven GOCO facilities. Besides overseeing the non-industrial waste study area of the project, Ms. Bramlett also worked on a more in-depth waste recovery feasibility analysis for one selected GOCO facility.

Ms. Bramlett was also a major technical contributor and sampling team member in a project for the USEPA in which data was gathered on the composition of leachate from hazardous waste sites located throughout the United States. The data will be used to assess the feasibility of formulating a synthetic leachate to test liner compatibility.

Ms. Bramlett was also a member of the field team which conducted groundwater sampling at the LiPari Landfill in New Jersey, Superfund Site No. 1. Sample analyses results were used to assess the performance of implemented remedial actions.

Ms. Bramlett's other field experience includes air sampling for asbestos in post offices in rural communities in western Pennsylvania and acting as a Document Control Officer during the geotechnical assessment of the hazardous waste disposal site Love Canal in New York. During the latter, she was responsible for ensuring adherence in the field to the project's Quality Assurance/Quality Control and Health and Safety plans. She additionally assisted in on-site hydrological testing to characterize groundwater.

Verified for accuracy by: Jennifer A. Bramlett Date: 10/5/85

SAIC

Under a project for EPA's Waste Identification Branch, Ms. Bramlett evaluated petitions from generators to exclude a waste listed under 40 CFR Part 261, Subpart D. She evaluated the delisting petitions for completeness and technical adequacy and prepared draft Federal Register Notices announcing an Agency decision. Ms. Bramlett also provided input on the content and format of a guidance manual for petition preparation.

Ms. Bramlett was active in a multi-year Industry Studies Program for the U.S. EPA Office of Solid Waste. The program was an in-depth waste management assessment of chemical classes within several industrial segments. Ms. Bramlett participated in the comprehensive waste management assessments of the chlorinated and brominated organics and carbamate industrial segments.

Ms. Bramlett was a major technical contributor to the U.S. EPA Technical Assistance Panels Programs for Regions III, V, and EPA Headquarters. The Programs provided assistance to state and local governments in both solid and hazardous waste management. For various technical assistance recipients, Ms. Bramlett assessed waste management options, evaluated waste management programs, and analysed the feasibility of waste-to-energy recovery.

PUBLICATIONS

Burger, B., J. Bramlett, K. Boyer, C. Furman. Installation Restoration Program Phase I - Records Search, Air Force Plant 19, San Diego, California. Prepared for: Wright-Patterson AFB, Ohio; September 1984.

JRB Associates. Solid Waste Data - A Compilation of Statistics on Solid Waste Management within the United States. Prepared for: U.S. Environmental Agency, Office of Solid Waste and Emergency Response. EPA contract no.: 68-01-6000. August 1981.

Verified for accuracy by: Jennifer A. Bramlett Date: 10/5/85

SAIC

CLAUDIA FURMAN

EDUCATION

Franklin and Marshall College, B.A., Geology (1981)

EXPERIENCE

Claudia Furman is a Geologist with JRB's Waste Management Division and has been involved in numerous and varied projects since joining the JRB staff.

Ms. Furman has recently been involved in the Air Force Installation Restoration Program under which she has been an integral part of the Phase I studies conducted for the Olmsted AFB in Pennsylvania, the Hanscom AFB in Massachusetts, and AF Plant 19 in California. The purpose of these studies has been to identify and estimate the potential for environmental contamination from past waste disposal practices on Air Force property. During both studies Ms. Furman acted as one of several key staff members involved in the gathering, interpretation and evaluation of data for the study areas. The final reports address the need for a follow on Phase II verification program on and around the three sites.

Ms. Furman served as one of several researchers on a task involving the identification of improved techniques for the removal, treatment and disposal or in-place treatment of contaminated sediments. She was a key participant in a sub-task that involved gathering data on the chemical and physical characteristics of chemical substances in order to identify those chemicals with a high hazard and persistence potential. Ms. Furman was also involved in the preparation of a case study reports regarding the use of contaminated sediment removal techniques.

Under a task providing support to OERR for technical and policy issues in the Superfund Program, Ms. Furman was involved in the formulation of a remedial technology development and screening methodology. The methodology utilizes technical criteria such as specific site, waste, and technology conditions and limitations to exclude inappropriate remedial actions for specific site conditions, thereby generating the most technically feasible options for the existing problem.

Ms. Furman was one of several investigators for a project that involves a nationwide survey of completed remedial actions at uncontrolled hazardous waste facilities. From this survey, twelve sites were selected for detailed case study analysis. Each site analysis involved the different technologies used, their effectiveness, design, implementation, and cost. The end product of this effort is a document containing twelve detailed technical case study reports intended for use as guidance on remedial action selection and implementation.

Verified for accuracy by: _____ Date: _____

SAIC

CLAUDIA A. FURMAN

Ms. Furman acted as one of several geologists supervising the drilling and installation of groundwater monitoring wells and well points at a Superfund site in New Jersey. The purpose of the monitoring program implemented at the site is to monitor the effectiveness of the remedial measures that were taken to control the movement of contaminated groundwater. During the well installation program, Ms. Furman shared the responsibility of overseeing the auger drill rig operations; collecting and characterizing core samples and the preparation of daily logs.

Ms. Furman was involved in a groundwater monitoring and sampling program at a site in Warminster, Pennsylvania, for the Naval Air Development Center. She particiapted in the sampling of 14 wells that were installed by JRB around several areas of suspected hazardous waste disposal.

Ms. Furman was involved in developing a technical handbook for EPA, Cincinnati, Ohio, on the design, construction, and performance evaluation of slurry trench cut-off walls used as pollutant migration control barriers. Her tasks included an extensive literature search, information compilation, data review, and contributing to the preparation of the final document.

Under JRB's Chlorinated Organics Industry Study, Ms. Furman managed the preliminary investigation and assessment of 12 chlorinated organic manufacturing facilities. This task involved the compilation and organization of site-specific environmental and waste-type data, information and data review, criteria evaluation and site assessment. The site assessments have been used to preliminarily characterize the nation's chlorinated organics industry. In addition to the above task, Ms. Furman reviewed groundwater model literature and cost-benefit analysis methods, compiled bibliographies, and prepared the information in tabular and report formats. This information constitutes the preliminary basis for selecting a groundwater model to be used in assessing chlorinated organic facilities and a cost-benefit analysis method for determining regulatory impact on the industry.

Ms. Furman made significant contributions to a project requiring the characterization and evaluation of 100 surface impoundments in Northen Virginia. Her responsibilities include literature compilation, data review, criteria evaluation and site investigation to determine compliance or noncompliance with the "Criteria for Classification of Solid Waste Disposal Facilities and Practices." Subsequent to this study , she wrote several sections of the final report "An Assessment of the Hazard Potential of 100 Surface Impoundments in Virginia."

Ms. Furman was involved in the research and writing of the "Emergency Drum Handling Practices at Abandoned Dump Sites" manual prepared for EPA's Municipal Environmental Research Laboratory in Edison, New Jersey. Her responsibilities include a literature search, information review, and the writing of several sections of the manual.

Verified for accuracy by: _____ Date: _____

SAIC

SHAHID MAHMUD

EDUCATION

Virginia Polytechnic Institute: B.S., Chemical Engineering (1983)

EXPERIENCE

Mr. Mahmud is a Chemical Engineer in JRB's Waste Management Department. He has a broad academic background in mass transfer operations, surface chemistry, process engineering and process design. He is currently involved in preparing a Guidance Manual for EPA's Municipal Environmental Research Lab examining methods to prevent overtopping of waste lagoons. Mr. Mahmud is specifically involved in examining conventional cover systems from air supported structures to floating covers. He is also curently involved in reviewing delisting petitions submitted by hazardous waste generators and treatment facilities.

Mr. Mahmud has also assisted the EPA Effluent Guidelines Division in the development of a computerized data base for establishing effluent discharge regulations for the Organic Chemicals, Plastics and Synthetic Fibers Industrial Category. He is involved in reviewing questionnaires to ensure that they are complete and technically correct. He contacted industry representatives in order to gather additional data and to clarify discrepencies in the questionnaire responses. He has also been involved with Phase I of the Installation Restoration Program (IRP) for DOD in which a detailed literature search was conducted on the waste management and manufacturing conducted activities at Air Force Plant 19 in San Diego, California. Mr. Mahmud was responsible for examining past and present activities associated with Plant 19.

Since joining JRB, he has been involved in a project for EPA's Municipal Environmental Research Laboratory to provide EPA response personnel with contamination avoidance and decontamination techniques for mobile response equipment in order to prevent exposures of hazardous substances to the community, response personnel and the environment to hazardous substances. His responsibilities included examining literature regarding alternate solid waste transfer techniques, protective surface coatings, and personal protective outergarments. He was also responsible for analyzing the engineering design of the IT Enviroscience Mobile Incinerator and recommended equipment retrofitting.

Prior to joining JRB, as a senior intern with Science Applications, Inc. Mr. Mahmud assisted in the identification of heavy oil resevoirs throughout the US which are amenable to thermal enhanced oil recovery techniques. The study entailed the development of a computerized data base for evaluating oil resevoir parameters, and screening criteria to isolate pools containing more that 10 million barrels oil-in place, recoverable by thermal oil recovery. As a senior intern with M&M Enterprises, Mr. Mahumd helped to evaluate the chemical characteristics of soils and overburden materials at two surface mining sites to determine the potential for preventing acid mine drainage problems in the area. This study assisted the Office of Surface Mining in determining the appropriate actions for acid-mine drainage control.

Verified for Accuracy by: Shahid Mahmud Date: 8/22/84

JOSHUA D. MARGOLIS

EDUCATION

Duke University: B.A., Public Policy - cum laude (1981)
Also completed undergraduate course work at Dartmouth (1976) and Harvard Ext. (1977)

EXPERIENCE

Mr. Margolis is an Environmental and Regulatory Analyst with JRB's Waste Management Department. In this capacity he is involved in the performance of environmental audits, preparation of waste management system studies, industrial resource recovery analyses, and regulatory impact analyses. He has a broad academic background including biology, botany, chemistry, geology, oceanography, environmental policy, hazardous waste management, economics, statistics, and cost/benefit analysis. Mr. Margolis has work experience with both JRB Associates and the U.S. EPA, Office of Solid Waste, Hazardous and Industrial Waste Division.

Mr. Margolis is a principal in JRB's Environmental Audit EA program. He has played a major role in the development of audit methodologies and materials for clients with diverse needs and resources. Mr. Margolis is currently part of a 5-member team providing EA assistance to Pacific Gas and Electric Company, the largest electric utility in the United States. Under this effort, JRB will audit and provide reports on two representative facilities, develop an EA guidance manual, and train PG&E staff in EA methodologies and techniques. Mr. Margolis will participate in all phases of this effort. In other work in this area Mr. Margolis:

- Participated in all phases of an EA effort for the Air Force to provide comprehensive multi-media assessments and recommendations for environmental compliance, hazard areas, and energy and materials recovery activities for 19 contractors located at 15 GOCO facilities. The effort involved the production of over 30 draft and final reports and was completed in a 10 month period.
- Participated in a more detailed assessment of materials and waste-to-energy opportunities at the above GOCO facilities.
- Assisted U.S. EPA and Region VIII in the development and execution of an EA conference for Western Federal facilities attended by 134 conferees.
- Participated in a Phase I IRP investigation of a GOCO facility to define potential areas of contamination.
- Assisted in the performance of Environmental Impairment Liability investigations of industrial facilities for a major insurance firm.

Verified for accuracy by: Joshua D. Margolis Date: 3/26/84

JOSHUA D. MARGOLIS

In addition to these efforts, Mr. Margolis has played a lead technical role in a project designed to supply the U.S. EPA with an information base upon which regulatory impact analyses can be performed on existing RCRA hazardous waste storage regulations. In support of this effort, Mr. Margolis:

- Co-authored a report defining hazards associated with ignitable wastes and methods of prevention/mitigation
- Co-authored a report detailing hazards associated with ignitable, corrosive, reactive, and toxic wastes and waste-dependent and independent variables influencing those hazards
- Performed on-site reviews of nine hazardous waste storage facilities to evaluate review storage configurations, assess compliance status, develop waste management costs, and elicit suggestions for regulatory modifications.

The results from these and other RIA efforts have been incorporated into EPA rule-making activities designed to define Part 264/265 regulations and develop Part 266 storage regulations.

Prior to these efforts, Mr. Margolis served as a lead technical person for a project which provided an evaluation of the status of resource recovery in eleven industry groups for the U.S. EPA's Office of Solid Waste and Emergency Response. Included within these groups are the Leather and Leather Products, Petroleum, Plastics, and Fabricated Metals industries. Key areas of this investigation and analysis include:

- Characterization of industry waste streams
- Process descriptions of applicable resource recovery waste streams
- Assessments of the stage of development of resource recovery technologies as applied to specific waste streams
- Descriptions of transfer and use of recovered materials
- Evaluations of technical, economic, regulatory, and institutional factors supporting or impeding the further development of resource recovery technologies.

In support of this project, Mr. Margolis has co-authored a report on the status of resource recovery in the Leather Products industry, provided technical assistance, and performed reviews of subsequent reports.

Verified for accuracy by: Joshua D. Margolis Date: 3/26/84

EDWARD W. REPA

EDUCATION

West Virginia University, Ph.D. Hydrology (1981)
West Virginia University, M.S.F. Hydrology (1977)
Baldwin-Wallace College, B.S. Biology (1975)

EXPERIENCE

Dr. Repa is currently a Program Manager in the Applied Technologies Division of the Waste Management Department. In this capacity, he directs the efforts of geologists, hydrologists, soil scientists and environmental scientists on projects directed at resolving hazardous waste management, technical and policy issues. Dr. Repa is currently managing approximately $1.5 million in tasks under the Air Force's Installation Restoration Program and $1.0 million in tasks under a task order contract with EPA's Office of Research and Development.

Dr. Repa is currently Project Manager (PM) and Principal Investigator (PI) on two Superfund research and development programs. One program is being performed at the Lipari Landfill in Pitman, NJ (Superfund Site Number 1) to assess the performance of the slurry wall and surface cap installed as the remedial action. The other program is being performed at the Western Processing Site in Kent, WA (Superfund Site Number 48) to assess the effectiveness of the asphalt surface cap in minimizing groundwater recharge.

Dr. Repa is the PM for an EPA project that is developing a manual on proven and innovative technologies for controlling the migration of hazardous waste leachate plumes. He led and developed one of the chapters of this manual entitled Groundwater Pumping. This chapter dealt with all aspects of well systems for plume control including well theory, design, installation, and costs. He is also serving as a Senior Technical Reviewer for the other chapters: Plume Dynamics, Plume Delineation, Control Technology Selection, Subsurface Drains, Impermeable Barriers, and Innovative Technologies.

Dr. Repa is also managing or has managed numerous projects under the Air Force's Installation Restoration Program (IRP). These include both Phase I-Records Search and Phase II-Confirmation/Quantification projects. IRP projects that he has participated in include: Phase I--Olmsted AFB, Harrisburg, PA; Air Force Plant PJKS, Waterton, CO; Air Force Plant 44, Tucson, AZ; and Phase II--Hancock Field, Syracuse, NY; Niagara Falls AFB, Niagara Falls, NY; Dover AFB, Dover, DE; Homested AFB, Homested, FL; Charleston AFB, Charleston, SC; McEntire ANG, Columbia, SC. In the role of PM/PI on these projects, Dr. Repa has developed groundwater monitoring plans, supervised the installation of monitoring wells and the collection of water quality samples, and coordinated the interpretation of hydrogeologic data.

Verified for Accuracy by: _____ Date: 22 March 85

SAIC

In addition to these current projects, he has also served as PM/PI on over thirty hydrogeologic impact assessments for the coal mining industry. In this role, he also supervised the installation of many monitoring wells, participated in the collection of groundwater, surface water and biotic samples, and coordinated the data interpretation and prediction of the probable hydrologic impacts from the mining operations.

Dr. Repa has also served as a Project Manager or Principal Investigator on a number of projects including:

- A theoretical evaluation of subsurface drains for use in landfills that are partially or fully located below the groundwater table.
- A review, evaluation, and critique of existing numerical and analytical groundwater models for their possible application to risk assessments associated with hazardous waste sites.
- The development of a specification manual on engineering systems that can be used to accelerate stabilization of hazardous waste piles or deposits.
- The development of groundwater monitoring plans and protocols for a Part B applicant at a hazardous waste site.

PUBLICATIONS

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Verified for Accuracy by: _____ Date: _____

SAIC

APPENDIX B

LIST OF INTERVIEWEES
AND
OUTSIDE AGENCY CONTACTS

LIST OF INTERVIEWEES

POSITION AND EMPLOYER	PERIOD OF EMPLOYMENT
Manager of Environmental Programs Hughes Aircraft Company Tucson, Arizona	1951 - Present
Staff Engineer Hughes Aircraft Company Tucson, Arizona	1953 - Present
Facilities Engineer Hughes Aircraft Company Tucson, Arizona	1979 - Present
Facilities Engineer Hughes Aircraft Company Tucson, Arizona	1983 - Present
Facilities Engineer Hughes Aircraft Company Tucson, Arizona	1982 - Present
Facilities Engineer Hughes Aircraft Company Tucson, Arizona	1969 - Present
Acting Administrator of Environmental Health & Safety Hughes Aircraft Company Tucson, Arizona	1955 - Present
Facilities Engineer Hughes Aircraft Company Tucson, Arizona	1983 - Present
Chemical Store Keeper Hughes Aircraft Company Tucson, Arizona	1973 - Present

Information obtained from an interviewee is referenced on tables and figures as "HAC, 1984".

OUTSIDE AGENCY CONTACTS

AGENCY	POINT OF CONTACT
USAF Hospital/SGPB Davis-Monthan Air Force Base Tucson, Arizona	Major Peter Lurker Chief, Bioenvironmental Engineering (602) 748-5369
U.S. Geological Survey 300 West Congress Street Tucson, Arizona	Stan Leake Hydrologist (602) 629-6540
Arizona Department of Health Services Office of Emergency Response and Remedial Action 2005 North Central Phoenix, Arizona	James Angell Hydrologist (602) 257-2361
Tucson Water 111 East Pennington City of Tuscon Tucson, Arizona	Joseph Babcock Hydrologist (602) 791-4331
Soil Conservation Service Tucson Area Office 3241 North Romero Road Tucson, Arizona	Chris Cochran Soil Survey Party Leader (602) 629-6602
U.S. Geological Survey 300 West Congress Street Tucson, Arizona	Natalie White Hydrologist (602) 629-6850

APPENDIX C

MASTER LIST OF INDUSTRIAL SHOPS

MASTER LIST OF INDUSTRIAL SHOPS

Shop or Department	Building Location	Hazardous Materials Handled	Hazardous Materials (Waste) Generated
Machine Shops	801	Yes	Yes
Assembly Shops	801	Yes	Yes
Spot Welding Shop	801	Yes	Yes
Plating Shop	801	Yes	Yes
Printed Circuit Board Area (Etch Circuitry)	810	Yes	Yes
Deburr Shop	814	Yes	Yes
Heat Treatment Shop	814	Yes	Yes
Paint Shop	814	Yes	Yes
Plastic Shop	801	Yes	Yes
Electronic Assembly Shop	809	No	No
Maintenance Machine Shop	816	Yes	Yes
Maintenance Paint Shop	816	Yes	Yes
Cabinet Shop	830	No	No
Paint Shop	830	Yes	Yes
Sheet Metal Shop	830	No	No
Welding Shop	830	Yes	Yes
Vehicle Maintenance Steam Cleaning Area	833	No	No
Wastewater Treatment Plant	815	Yes	Yes

APPENDIX D

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REFERENCES

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APPENDIX E

AF HAZARD ASSESSMENT RATING METHODOLOGY

USAF INSTALLATION RESTORATION PROGRAM
HAZARD ASSESSMENT RATING METHODOLOGY

BACKGROUND

The Department of Defense (DoD) has established a comprehensive program to identify, evaluate, and control problems associated with past disposal practices at DoD facilities. One of the actions required under this program is to:

> "develop and maintain a priority listing of contaminated installations and facilities for remedial action based on potential hazard to public health, welfare, and environmental impacts." (Reference: DEQPPM 81-5, 11 December 1981).

Accordingly, the United States Air Force (USAF) has sought to establish a system to set priorities for taking further actions at sites based upon information gathered during the Records Search phase of its Installation Restoration Program (IRP).

The first site rating model was developed in June 1981 at a meeting with representatives from USAF Occupational and Environmental Health Laboratory (OEHL), Air Force Engineering and Services Center (AFESC), Engineering-Science (ES) and CH2M HILL The basis for this model was a system developed for EPA by JRB Associates of McLean, Virginia. The JRB model was modified to meet Air Force needs.

After using this model for 6 months at over 20 Air Force installations, certain inadequacies became apparent. Therefore, on January 26 and 27, 1982, representatives of USAF OEHL, AFESC, various major commands, Engineering

Science, and CH2M HILL met to address the inadequacies. The result of the meeting was a new site rating model designed to present a better picture of the hazards posed by sites at Air Force installations. The new rating model described in this presentation is referred to as the Hazard Assessment Rating Methodology.

PURPOSE

The purpose of the site rating model is to provide a relative ranking of sites of suspected contamination from hazardous substances. This model will assist the Air Force in setting priorities for follow-on site investigations and confirmation work under Phase II of IRP.

This rating system is used only after it has been determined that (1) potential for contamination exists (hazardous wastes present in sufficient quantity), and (2) potential for migration exists. A site can be deleted from consideration for rating on either basis.

DESCRIPTION OF MODEL

Like the other hazardous waste site ranking models, the U.S. Air Force's site rating model uses a scoring system to rank sites for priority attention. However, in developing this model, the designers incorporated some special features to meet specific DoD program needs.

The model uses data readily obtained during the Record Search portion (Phase I) of the IRP. Scoring judgments and computations are easily made. In assessing the hazards at a given site, the model develops a score based on the most likely routes of contamination and the worst hazards at the site. Sites are given low scores only if there are clearly no hazards at the site. This approach meshes well with the

policy for evaluating and setting restrictions on excess DoD properties.

Site scores are developed using the appropriate ranking factors according to the method presented in the flow chart (Figure 1). The site rating form is provided in Figure 2 and the rating factor quidelines are provided in Table 1.

As with the previous model, this model considers four aspects of the hazard posed by a specific site: the possible receptors of the contamination, the waste and its characteristics, the potential pathways for waste contaminant migration, and any efforts to contain the contamination. Each of these categories contains a number of rating factors that are used in the overall hazard rating.

The receptors category rating is calculated by scoring each factor, multiplying by a factor weighting constant, and adding the weighted scores to obtain a total category score.

The pathways category rating is based on evidence of contaminant migration or an evaluation of the highest potential (worst case) for contaminant migration along one of three pathways. If evidence of contaminant migration exists, the category is given a subscore of 80 to 100 points. For indirect evidence, 80 points are assigned and for direct evidence 100 points are assigned. If no evidence is found, the highest score among three possible routes is used. These routes are surface-water migration, flooding, and ground-water migration. Evaluation of each route involves factors associated with the particular migration route. The three pathways are evaluated and the highest score among all four of the potential scores is used.

The waste characteristics category is scored in three steps. First, a point rating is assigned based on an assessment of the waste quantity and the hazard (worst case) associated with the site. The level of confidence in the information is also factored into the assessment. Next, the score is multiplied by a waste persistence factor, which acts to reduce the score if the waste is not very persistent. Finally, the score is further modified by the physical state of the waste. Liquid wastes receive the maximum score, while scores for sludges and solids are reduced.

The scores for each of the three categories are then added together and normalized to a maximum possible score of 100. Then the waste management practice category is scored. Sites at which there is no containment are not reduced in score. Scores for sites with limited containment can be reduced by 5 percent. If a site is contained and well managed, its score can be reduced by 90 percent. The final site score is calculated by applying the waste management practices category factor to the sum of the scores for the other three categories.

SITE RATING METHODOLOGY FLOW CHART

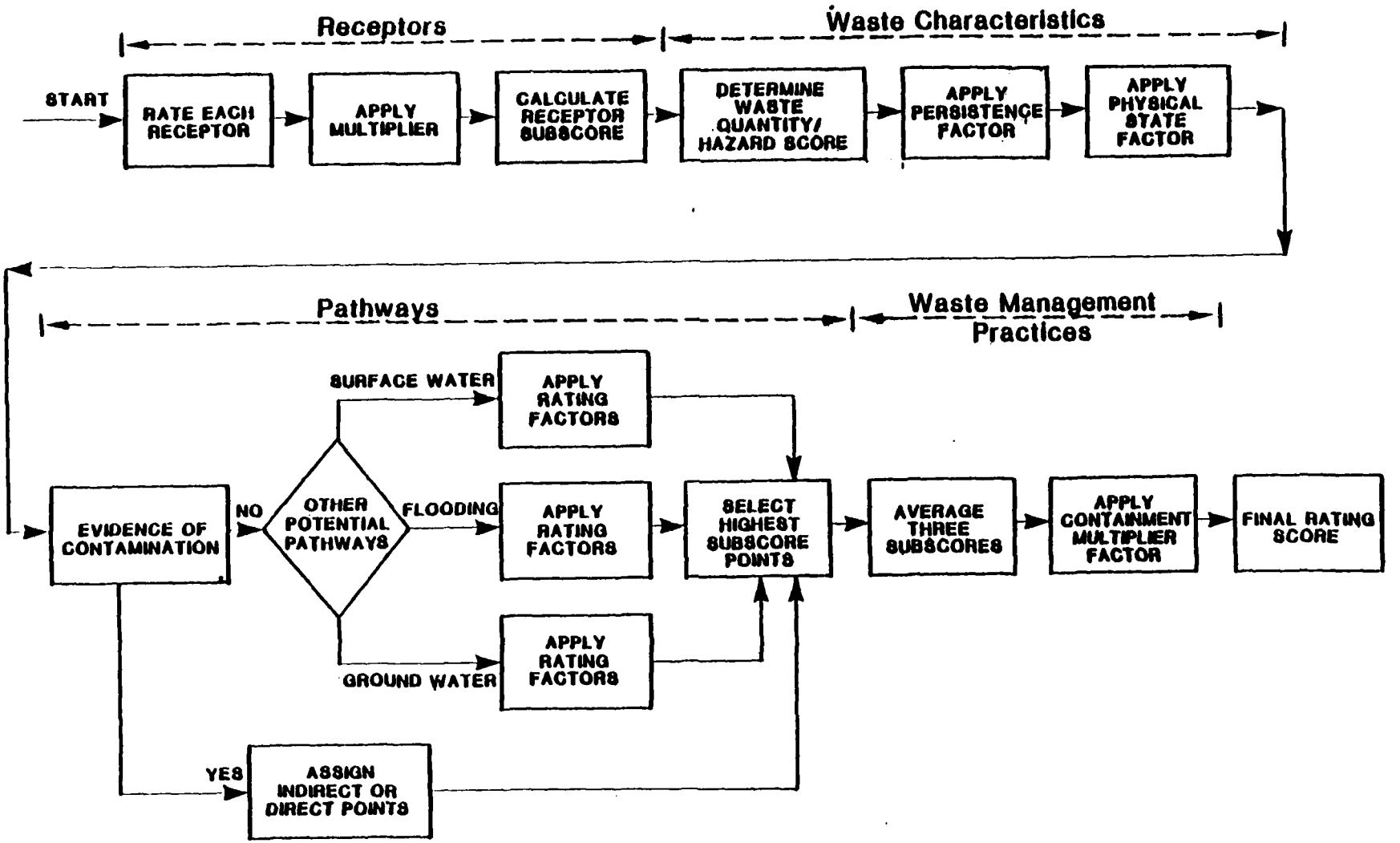


FIGURE 1

FIGURE 2

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE _____

LOCATION _____

DATE OF OPERATION OR OCCURRENCE _____

OWNER/OPERATOR _____

COMMENTS/DESCRIPTION _____

SITE RATED BY _____

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site		4		
B. Distance to nearest well		10		
C. Land use/zoning within 1 mile radius		3		
D. Distance to reservation boundary		6		
E. Critical environments within 1 mile radius of site		10		
F. Water quality of nearest surface water body		6		
G. Ground water use of uppermost aquifer		9		
H. Population served by surface water supply within 3 miles downstream of site		6		
I. Population served by ground-water supply within 3 miles of site		6		
		Subtotals	_____	_____

Receptors subscore (100 X factor score subtotal/maximum score subtotal) _____

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large) _____
2. Confidence level (C = confirmed, S = suspected) _____
3. Hazard rating (H = high, M = medium, L = low) _____

Factor Subscore A (from 20 to 100 based on factor score matrix) _____

B. Apply persistence factor
Factor Subscore A X Persistence Factor = Subscore B

_____ X _____ = _____

C. Apply physical state multiplier

Subscore B X Physical State Multiplier = Waste Characteristics Subscore

_____ X _____ = _____

III. PATHWAYS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore _____

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.

1. Surface water migration

Distance to nearest surface water		8		
Net precipitation		6		
Surface erosion		8		
Surface permeability		6		
Rainfall intensity		8		
		Subtotals	_____	_____

Subscore (100 X factor score subtotal/maximum score subtotal) _____

2. Flooding

Flooding		1		

Subscore (100 x factor score/3) _____

3. Ground-water migration

Depth to ground water		9		
Net precipitation		6		
Soil permeability		8		
Subsurface flows		8		
Direct access to ground water		8		
		Subtotals	_____	_____

Subscore (100 x factor score subtotal/maximum score subtotal) _____

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore _____

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors _____
Waste Characteristics _____
Pathways _____

Total _____ divided by 3 = _____
Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score X Waste Management Practices Factor = Final Score

_____ X _____ = _____

TABLE 1

HAZARDOUS ASSESSMENT RATING METHODOLOGY GUIDELINES

I. RECEPTOIS CATEGORY

Rating Factors	Rating Scale Levels 0	1	2	3	Multiplier
A. Population within 1,000 feet (includes on-base facilities)	0	1 - 25	26 - 100	Greater than 100	4
B. Distance to nearest water well	Greater than 3 miles	1 to 3 miles	3,001 feet to 1 mile	0 to 3,000 feet	10
C. Distance to installation boundary	Greater than 2 miles	1 to 2 miles	1,001 feet to 1 mile	0 to 1,000 feet	3
D. Land Use/Zoning (within 1 mile radius)	Completely remote (zoning not applicable)	Agricultural	Commercial or industrial	Residential	6
E. Critical environments (within 1 mile radius)	Not a critical environment	Natural areas	Pristine natural areas; minor wetlands; preserved areas; presence of economically important natural resources susceptible to contamination.	Major habitat of an endangered or threatened species; presence of recharge area; major wetlands.	10
F. Water quality/use designation of nearest surface water body	Agricultural or industrial use.	Recreation, propagation and management of fish and wildlife.	Shellfish propagation and harvesting.	Potable water supplies	6
G. Ground-Water use of uppermost aquifer	Not used, other sources readily available.	Commercial, industrial, or irrigation, very limited other water sources.	Drinking water, municipal water available.	Drinking water, no municipal water available; commercial, industrial, or irrigation, no other water source available.	9
H. Population served by surface water supplies within 3 miles downstream of site	0	1 - 50	51 - 1,000	Greater than 1,000	6
I. Population served by aquifer supplies within 3 miles of site	0	1 - 50	51 - 1,000	Greater than 1, 000	6

TABLE 1 (Continued)

HAZARDOUS ASSESSMENT RATING METHODOLOGY GUIDELINES (Cont'd)

II. WASTE CHARACTERISTICS

A-1 Hazardous Waste Quantity

S = Small quantity (5 tons or 20 drums of liquid)
M = Moderate quantity (5 to 20 tons or 21 to 85 drums of liquid)
L = Large quantity (20 tons or 85 drums of liquid)

A-2 Confidence Level of Information

C = Confirmed confidence level (minimum criteria below)

- o Verbal reports from interviewer (at least 2) or written information from the records.
- o Knowledge of types and quantities of wastes generated by shops and other areas on base.
- o Based on the above, a determination of the types and quantities of waste disposed of at the site.

S = Suspected confidence level

- o No verbal reports or conflicting verbal reports and no written information from the records.
- o Logic based on a knowledge of the types and quantities of hazardous wastes generated at the base, and a history of past waste disposal practices indicate that these wastes were disposed of at a site.

A-3 Hazard Rating

Hazard Category	Rating Scale Levels			
	0	1	2	3
Toxicity	Sax's Level 0	Sax's Level 1	Sax's Level 2	Sax's Level 3
Ignitability	Flash point greater than 200°F	Flash point at 140°F to 200°F	Flash point at 80°F to 140°F	Flash point less than 80°F
Radioactivity	At or below background levels	1 to 3 times background levels	3 to 5 times background levels	Over 5 times background levels

Use the highest individual rating based on toxicity, ignitability and radioactivity and determine the hazard rating.

Hazard Rating	Points
High (H)	3
Medium (M)	2
Low (L)	1

HAZARDOUS ASSESSMENT RATING METHODOLOGY GUIDELINES (Cont'd)

II. WASTE CHARACTERISTICS (Continued)

Waste Characteristics Matrix

Point Rating	Hazardous Waste Quantity	Confidence Level of Information	Hazard Rating
100	L	C	H
80	L	C	M
	M	C	H
70	L	S	H
60	S	C	H
	M	C	M
50	L	S	M
	L	C	L
	M	S	H
	S	C	M
40	S	S	H
	M	S	M
	M	C	L
	L	S	L
30	S	C	L
	M	S	L
	S	S	M
20	S	S	L

Notes:
For a site with more than one hazardous waste, the waste quantities may be added using the following rules:
Confidence Level
- o Confirmed confidence levels (C) can be added
- o Suspected confidence levels (S) can be added
- o Confirmed confidence levels cannot be added with suspected confidence levels

Waste Hazard Rating
- o Wastes with the same hazard rating can be added
- o Wastes with different hazard ratings can only be added in a downgrade mode, e.g., MCM + SCH = LCM if the total quantity is greater than 20 tons.

Example: Several wastes may be present at a site, each having an MCM designation (60 points). By adding the quantities of each waste, the designation may change to LCM (80 points). In this case, the correct point rating for the waste is 8[illegible].

B. Persistence Multiplier for Point Rating

Persistence Criteria	Multiply Point Rating From Part A by the Following
Metals, polycyclic compounds, and halogenated hydrocarbons	1.0
Substituted and other ring compounds	0.9
Straight chain hydrocarbons	0.8
Easily biodegradable compounds	0.4

C. Physical State Multiplier

Physical State	Multiply Point Total From Parts A and B by the Following
Liquid	1.0
Sludge	0.75
Solid	0.50

TABLE 1 (Continued)

HAZARDOUS ASSESSMENT RATING METHODOLOGY GUIDELINES (Cont'd)

III. PATHWAYS CATEGORY

A. Evidence of Contamination

Direct evidence is obtained from laboratory analyses of hazardous contaminants present above natural background levels in surface water, ground water, or air. Evidence should confirm that the source of contamination is the site being evaluated.

Indirect evidence might be from visual observation (i.e., leachate), vegetation stress, sludge deposits, presence of taste and odors in drinking water, or reported discharges that cannot be directly confirmed as resulting from the site, but the site is greatly suspected of being a source of contamination.

B-1 POTENTIAL FOR SURFACE WATER CONTAMINATION

Rating Factor	Rating Scale Levels 0	1	2	3	Multiplier
Distance to nearest surface water (includes drainage ditches and storm sewers)	Greater than 1 mile	2,001 feet to 1 mile	501 feet to 2,000 feet	0 to 500 feet	8
Net precipitation	Less than -10 in.	-10 to + 5 in.	+5 to +20 in.	Greater than +20 in.	6
Surface erosion	None	Slight	Moderate	Severe	8
Surface permeability	0% to 15% clay ($>10^{-2}$ cm/sec)	15% to 30% clay (10^{-2} to 10^{-4} cm/sec)	30% to 50% clay (10^{-4} to 10^{-6} cm/sec)	Greater than 50% clay ($<10^{-6}$ cm/sec)	6
Rainfall intensity based on 1 year 24-hr rainfall	<1.0 inch	1.0-2.0 inches	2.1-3.0 inches	>3.0 inches	8
B-2 POTENTIAL FOR FLOODING					
Floodplain	Beyond 100-year floodplain	In 25-year floodplain	In 10-year floodplain	Floods annually	1
B-3 POTENTIAL FOR GROUND-WATER CONTAMINATION					
Depth to ground water	Greater than 500 ft	50 to 500 feet	11 to 50 feet	0 to 10 feet	8
Net precipitation	Less than -10 in.	-10 to +5 in.	+5 to +20 in.	Greater than +20 in.	6
Soil permeability	Greater than 50% clay ($>10^{-6}$ cm/sec)	30% to 50% clay (10^{-4} to 10^{-6} cm/sec)	15% to 30% clay (10^{-2} to 10^{-4} cm/sec)	0% to 15% clay ($<10^{-2}$ cm/sec)	8
Subsurface flows	Bottom of site greater than 5 feet above high ground-water level	Bottom of site occasionally submerged	Bottom of site frequently submerged	Bottom of site located below mean ground-water level	8
Direct access to ground water (through faults, fractures, faulty well casing, bald fla	No evidence of risk	Low risk	Moderate risk	High risk	8

TABLE 1 (Continued)

HAZARDOUS ASSESSMENT RATING METHODOLOGY GUIDELINES (Cont'd)

IV. WASTE MANAGEMENT PRACTICES CATEGORY

A. This category adjusts the total risk as determined from the receptors, pathways, and waste characteristics categories for waste management practices and engineering controls designed to reduce this risk. The total risk is determined by first averaging the receptors, pathways, and waste characteristics subscores.

B. WASTE MANAGEMENT PRACTICES FACTOR

The following multipliers are then applied to the total risk points (from A):

Waste Management Practice	Multiplier
No containment	1.0
Limited containment	0.95
Fully contained and in full compliance	0.10

Guidelines for fully contained:

Landfills:

- o Clay cap or other impermeable cover
- o Leachate collection system
- o Liners in good condition
- o Adequate monitoring wells

Spills:

- o Quick spill cleanup action taken
- o Contaminated soil removed
- o Soil and/or water samples confirm total cleanup of the spill

Surface Impoundments:

- o Liners in good condition
- o Sound dikes and adequate freeboard
- o Adequate monitoring wells

Fire Proection Training Areas:

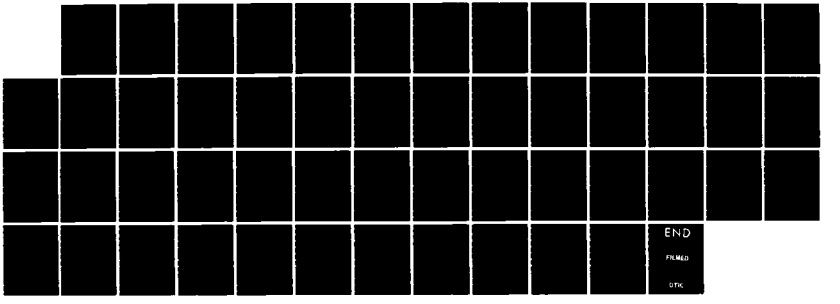
- o Concrete surface and berms
- o Oil/water separator for pretreatment of runoff
- o Effluent from oil/water separator to treatment plant

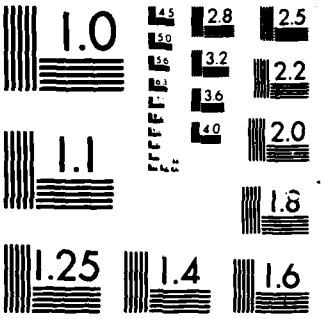
General Note: If data are not available or known to be complete the factor ratings under items I-A through I, III-B-1 or III-B-3, then leave blank for calculation of factor score and maximum possible score.

APPENDIX F

SITE RATING FORMS

AD-A163 889 INSTALLATION RESTORATION PROGRAM PHASE I RECORDS SEARCH 3/3
AIR FORCE PLANT 44 TUCSON ARIZONA(U) SCIENCE
APPLICATIONS INTERNATIONAL CORP MCLEAN VA OCT 85
UNCLASSIFIED F33657-81-E-2096 F/G 13/2 NL





MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS 1963-A

FIGURE 2

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE: Former Waste Disposal Pits (Site 3)

LOCATION: Comprises on area immediately west of Building 801

DATE OF OPERATION OR OCCURRENCE: 1966-1977

OWNER/OPERATOR: AFP 44

COMMENTS/DESCRIPTION: Disposal of liquid solvents including methyl chloride and 1,1,1-trichloroethylene

SITE RATED BY: E. Repa & C. Furman

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	0	4	0	12
B. Distance to nearest well HAC 1 and HAC 2	3	10	30	30
C. Land use/zoning within 1 mile radius	2	3	6	9
D. Distance to reservation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	0	10	0	30
F. Water quality of nearest surface water body	0	6	0	18
G. Ground water use of uppermost aquifer	3	9	27	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	3	6	18	18
		Subtotals	99	180

Receptors subscore (100 X factor score subtotal/maximum score subtotal): 55

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large): L
2. Confidence Level (C = confirmed, S = suspected): C
3. Hazard rating (H = high, M = medium, L = low): H

Factor Subscore A (from 20 to 100 based on factor score matrix): 100

B. Apply persistence factor
Factor Subscore A X Persistence Factor = Subscore B

100 X 1 = 100

C. Apply physical state multiplier

Subscore B X Physical State Multiplier = Waste Characteristics Subscore

100 X 1 = 100

III. PATHWAYS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 100

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.

1. Surface water migration

Distance to nearest surface water		8		
Net precipitation		6		
Surface erosion		8		
Surface permeability		6		
Rainfall intensity		8		
		Subtotals		

Subscore (100 X factor score subtotal/maximum score subtotal)

2. Flooding

		1		

Subscore (100 x factor score/3)

3. Ground-water migration

Depth to ground water		9		
Net precipitation		6		
Soil permeability		8		
Subsurface flows		9		
Direct access to ground water		8		
		Subtotals		

Subscore (100 x factor score subtotal/maximum score subtotal)

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 100

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	55
Waste Characteristics	100
Pathways	100

Total 255 divided by 3 = 85

Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score X Waste Management Practices Factor = Final Score

85 x 1 = 85

FIGURE 2

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE Former Wastewater Ponds (Site 4)

LOCATION Beneath existing evaporation ponds west of Building 801

DATE OF OPERATION OR OCCURRENCE 1954 through 1977

OWNER/OPERATOR AFP 44

COMMENTS/DESCRIPTION Disposal of process wastewaters and chromium/cyanide solutions

SITE RATED BY E. Repa and C. Furman

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	0	4	0	12
B. Distance to nearest well Cobb, Jack and SC-7	3	10	30	30
C. Land use/zoning within 1 mile radius	3	3	9	9
D. Distance to reservation boundary	2	6	12	18
E. Critical environments within 1 mile radius of site	0	10	0	30
F. Water quality of nearest surface water body	0	6	0	18
G. Ground water use of uppermost aquifer	3	9	27	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	3	6	18	18
		Subtotals	96	180

Receptors subscore (100 X factor score subtotal/maximum score subtotal) 53

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large) L
2. Confidence level (C = confirmed, S = suspected) C
3. Hazard rating (H = high, M = medium, L = low) H

Factor Subscore A (from 20 to 100 based on factor score matrix) 100

B. Apply persistence factor
Factor Subscore A X Persistence Factor = Subscore B

100 X 1 = 100

C. Apply physical state multiplier

Subscore B X Physical State Multiplier = Waste Characteristics Subscore

100 X 1 = 100

III. PATHWAYS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 100

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.

1. Surface water migration

Distance to nearest surface water		8		
Net precipitation		6		
Surface erosion		8		
Surface permeability		6		
Rainfall intensity		8		
		Subtotals		

Subscore (100 X factor score subtotal/maximum score subtotal)

2. Flooding

		1		

Subscore (100 x factor score/3)

3. Ground-water migration

Depth to ground water		9		
Net precipitation		6		
Soil permeability		8		
Subsurface flows		9		
Direct access to ground water		8		
		Subtotals		

Subscore (100 x factor score subtotal/maximum score subtotal)

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 100

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	53
Waste Characteristics	100
Pathways	100

Total 253 divided by 3 = 84

Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score X Waste Management Practices Factor = Final Score

84 X 1 = 84

FIGURE 2

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE Former Burn and Disposal Pit (Site 2)
LOCATION Southeast quadrant of plant property
DATE OF OPERATION OR OCCURRENCE 1955 through 1966
OWNER/OPERATOR AFP 44
COMMENTS/DESCRIPTION Burning/disposal of flammable liquids/solids and general disposal
SITE RATED BY E. Repa and C. Furman

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	0	4	0	12
B. Distance to nearest well HAC 4	2	10	20	30
C. Land use/zoning within 1 mile radius	2	3	6	9
D. Distance to reservation boundary	2	6	12	18
E. Critical environments within 1 mile radius of site	0	10	0	30
F. Water quality of nearest surface water body	0	6	0	18
G. Ground water use of uppermost aquifer	3	9	27	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	3	6	18	18
		Subtotals	83	180

Receptors subscore (100 X factor score subtotal/maximum score subtotal) 46

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large) L
2. Confidence level (C = confirmed, S = suspected) C
3. Hazard rating (H = high, M = medium, L = low) H

Factor Subscore A (from 20 to 100 based on factor score matrix) 100

B. Apply persistence factor
Factor Subscore A X Persistence Factor = Subscore B

100 x 1 = 100

C. Apply physical state multiplier

Subscore B X Physical State Multiplier = Waste Characteristics Subscore

100 x 1 = 100

III. PATHWAYS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 100

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.

1. Surface water migration

Distance to nearest surface water		8		
Net precipitation		6		
Surface erosion		8		
Surface permeability		6		
Rainfall intensity		8		
		Subtotals	____	____

Subscore (100 X factor score subtotal/maximum score subtotal) ____

2. Flooding

Flooding		1		

Subscore (100 x factor score/3) ____

3. Ground-water migration

Depth to ground water		8		
Net precipitation		6		
Soil permeability		8		
Subsurface flows		8		
Direct access to ground water		8		
		Subtotals	____	____

Subscore (100 x factor score subtotal/maximum score subtotal) ____

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 100

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	46
Waste Characteristics	100
Pathways	100

Total 246 divided by 3 = 82 Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score X Waste Management Practices Factor = Final Score

82 x 1 = 82

FIGURE 2

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE Former Sludge Drying Beds (Site 5)

LOCATION Adjacent to east side of Building 801

DATE OF OPERATION OR OCCURRENCE Early 1960s through 1977

OWNER/OPERATOR AFP 44

COMMENTS/DESCRIPTION Disposal of process wastewaters, sludges, and chromium/cyanide solutions

SITE RATED BY E. Repa and C. Furman

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	0	4	0	12
B. Distance to nearest well HAC 3 or SC-7	2	10	20	30
C. Land use/zoning within 1 mile radius	2	3	6	9
D. Distance to reservation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	0	10	0	30
F. Water quality of nearest surface water body	0	6	0	18
G. Ground water use of uppermost aquifer	3	9	27	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	3	6	18	18
		Subtotals	89	180

Receptors subscore (100 X factor score subtotal/maximum score subtotal) 49

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large) L
2. Confidence level (C = confirmed, S = suspected) C
3. Hazard rating (H = high, M = medium, L = low) H

Factor Subscore A (from 20 to 100 based on factor score matrix) 100

B. Apply persistence factor
Factor Subscore A X Persistence Factor = Subscore B

100 x 1 = 100

C. Apply physical state multiplier

Subscore B X Physical State Multiplier = Waste Characteristics Subscore

100 x 1 = 100

III. PATHWAYS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 100

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.

1. Surface water migration

Distance to nearest surface water		8		
Net precipitation		6		
Surface erosion		8		
Surface permeability		6		
Rainfall intensity		8		
		Subtotals		

Subscore (100 X factor score subtotal/maximum score subtotal)

2. Flooding

Flooding		1		

Subscore (100 x factor score/3)

3. Ground-water migration

Depth to ground water		9		
Net precipitation		6		
Soil permeability		8		
Subsurface flows		8		
Direct access to ground water		8		
		Subtotals		

Subscore (100 x factor score subtotal/maximum score subtotal)

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 100

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	49
Waste Characteristics	100
Pathways	100
Total 249 divided by 3 =	83
	Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score X Waste Management Practices Factor = Final Score

83 x .95 = 79

FIGURE 2

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE Drainage Channels (Site 6)

LOCATION Network of channels west of Building 801

DATE OF OPERATION OR OCCURRENCE 1952 through 1977

OWNER/OPERATOR AFP 44

COMMENTS/DESCRIPTION Directed process wastewaters to the area west of Building 801

SITE RATED BY E. Repa and C. Furman

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	1	4	4	12
B. Distance to nearest well Jack/Cobb/SC-7	3	10	30	30
C. Land use/zoning within 1 mile radius	3	3	9	9
D. Distance to reservation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	0	10	0	30
F. Water quality of nearest surface water body	0	6	0	18
G. Ground water use of uppermost aquifer	3	9	27	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	3	6	18	18
		Subtotals	106	180

Receptors subscore (100 X factor score subtotal/maximum score subtotal) 59

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large) L
2. Confidence level (C = confirmed, S = suspected) C
3. Hazard rating (H = high, M = medium, L = low) H

Factor Subscore A (from 20 to 100 based on factor score matrix) 100

B. Apply persistence factor

Factor Subscore A X Persistence Factor = Subscore B

100 X 1 = 100

C. Apply physical state multiplier

Subscore B X Physical State Multiplier = Waste Characteristics Subscore

100 X 1 = 100

III. PATHWAYS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore _____

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.

1. Surface water migration

Distance to nearest surface water	3	8	24	24
Net precipitation	0	6	0	18
Surface erosion	1	8	8	24
Surface permeability	1	6	6	18
Rainfall intensity	1	8	8	24
		Subtotals	46	108

Subscore (100 X factor score subtotal/maximum score subtotal) 43

2. Flooding

	0	1	0	0

Subscore (100 x factor score/3) _____

3. Ground-water migration

Depth to ground water (80 feet to perched zone)	1	8	8	24
Net precipitation	0	6	0	18
Soil permeability	2	8	16	24
Subsurface flows	0	8	0	24
Direct access to ground water	0	8	0	24
		Subtotals	24	114

Subscore (100 x factor score subtotal/maximum score subtotal) 21

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 43

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	59
Waste Characteristics	100
Pathways	43
Total 202 divided by 3 =	67
	Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score X Waste Management Practices Factor = Final Score

67 X 1 = 67

FIGURE 2

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE: Former Disposal Trenches (Site 1)

LOCATION: Southeast border of plant property

DATE OF OPERATION OR OCCURRENCE: 1952 through 1955

OWNER/OPERATOR: AFP 44

COMMENTS/DESCRIPTION: Disposal of both nonhazardous and industrial wastes

SITE RATED BY: E. Repa and C. Furman

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	0	4	0	12
B. Distance to nearest well HAC 4	3	10	30	30
C. Land use/zoning within 1 mile radius	2	3	6	9
D. Distance to reservation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	0	10	0	30
F. Water quality of nearest surface water body	0	6	0	18
G. Ground water use of uppermost aquifer	3	9	27	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	3	6	18	18
		Subtotals	99	180

Receptors subscore (100 X factor score subtotal/maximum score subtotal): 55

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large): S
2. Confidence level (C = confirmed, S = suspected): S
3. Hazard rating (H = high, M = medium, L = low): H

Factor Subscore A (from 20 to 100 based on factor score matrix): 40

B. Apply persistence factor

Factor Subscore A X Persistence Factor = Subscore B

40 X 1 = 40

C. Apply physical state multiplier

Subscore B X Physical State Multiplier = Waste Characteristics Subscore

40 X 1 = 40

III. PATHWAYS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 100

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.

1. Surface water migration

Distance to nearest surface water		8		
Net precipitation		6		
Surface erosion		8		
Surface permeability		6		
Rainfall intensity		8		
		Subtotals	____	____

Subscore (100 X factor score subtotal/maximum score subtotal) ____

2. Flooding

Flooding		1		

Subscore (100 x factor score/3) ____

3. Ground-water migration

Depth to ground water		8		
Net precipitation		6		
Soil permeability		8		
Subsurface flows		8		
Direct access to ground water		8		
		Subtotals	____	____

Subscore (100 x factor score subtotal/maximum score subtotal) ____

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 100

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	55
Waste Characteristics	40
Pathways	100

Total 195 divided by 3 = 65

Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score X Waste Management Practices Factor = Final Score

65 x 1 = 65

FIGURE 2

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE: North Fire Training Area (Site 7)

LOCATION: Southeast of Building 830

DATE OF OPERATION OR OCCURRENCE: Middle to late 1950s

OWNER/OPERATOR: AFP 44

COMMENTS/DESCRIPTION: Burning of flammable solvents, acetone; MEK

SITE RATED BY: E. Repa and C. Furman

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	0	4	0	12
B. Distance to nearest well HAC 3	3	10	30	30
C. Land use/zoning within 1 mile radius	2	3	6	9
D. Distance to reservation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	0	10	0	30
F. Water quality of nearest surface water body	0	6	0	18
G. Ground water use of uppermost aquifer	3	9	27	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	3	6	18	18
		Subtotals	99	180

Receptors subscore (100 X factor score subtotal/maximum score subtotal): 55

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large): M
2. Confidence level (C = confirmed, S = suspected): C
3. Hazard rating (H = high, M = medium, L = low): H

Factor Subscore A (from 20 to 100 based on factor score matrix): 80

B. Apply persistence factor

Factor Subscore A X Persistence Factor = Subscore B

80 x 1 = 80

C. Apply physical state multiplier

Subscore B X Physical State Multiplier = Waste Characteristics Subscore

80 x 1 = 80

III. PATHWAYS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore _____

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.

1. Surface water migration

Distance to nearest surface water	3	8	24	24
Net precipitation	0	6	0	18
Surface erosion	1	8	8	24
Surface permeability	1	6	6	18
Rainfall intensity	1	8	8	24
		Subtotals	46	108

Subscore (100 X factor score subtotal/maximum score subtotal) 43

2. Flooding

Flooding	0	1	0	

Subscore (100 x factor score/3) 0

3. Ground-water migration

Depth to ground water	1	8	8	24
Net precipitation	0	6	0	18
Soil permeability	2	8	16	24
Subsurface flows	0	8	0	24
Direct access to ground water	0	8	0	24
		Subtotals	24	114

Subscore (100 x factor score subtotal/maximum score subtotal) 21

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 43

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	55
Waste Characteristics	80
Pathways	43

Total 178 divided by 3 = 59 Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score X Waste Management Practices Factor = Final Score

59 x 0.95 = 56

FIGURE 2

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE: Diesel Fuel Tank (Site 12)
LOCATION: Between Buildings 801 and 810
DATE OF OPERATION OR OCCURRENCE: Start of occurrence unknown
OWNER/OPERATOR: AFP 44
COMMENTS/DESCRIPTION: Underground 10,000-gallon fuel tank
SITE RATED BY: E. Repa and C. Furman

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	0	4	0	12
B. Distance to nearest well HAC 1	3	10	30	30
C. Land use/zoning within 1 mile radius	2	3	6	9
D. Distance to reservation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	0	10	0	30
F. Water quality of nearest surface water body	0	6	0	18
G. Ground water use of uppermost aquifer	3	9	27	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	3	6	18	18
		Subtotals	99	180

Receptors subscore (100 X factor score subtotal/maximum score subtotal): 55

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large): S
2. Confidence level (C = confirmed, S = suspected): S
3. Hazard rating (H = high, M = medium, L = low): H

Factor Subscore A (from 20 to 100 based on factor score matrix): 40

B. Apply persistence factor
Factor Subscore A X Persistence Factor = Subscore B

40 x 0.8 = 32

C. Apply physical state multiplier

Subscore B X Physical State Multiplier = Waste Characteristics Subscore

32 x 1 = 32

III. PATHWAYS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 80

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.

1. Surface water migration

Distance to nearest surface water		8		
Net precipitation		6		
Surface erosion		8		
Surface permeability		6		
Rainfall intensity		8		
		Subtotals		

Subscore (100 X factor score subtotal/maximum score subtotal)

2. Flooding

		1		

Subscore (100 x factor score/3)

3. Ground-water migration

Depth to ground water		9		
Net precipitation		6		
Soil permeability		8		
Subsurface flows		9		
Direct access to ground water		9		
		Subtotals		

Subscore (100 x factor score subtotal/maximum score subtotal)

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 80

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	55
Waste Characteristics	32
Pathways	80
Total 167 divided by 3 =	56
	Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score X Waste Management Practices Factor = Final Score

56 X 1 = 56

FIGURE 2

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE South Fire Training Area (Site 8)

LOCATION Southeast area of plant property at the water tower

DATE OF OPERATION OR OCCURRENCE Early 1960s

OWNER/OPERATOR AFP 44

COMMENTS/DESCRIPTION "Flow fires" using flammable fluids discharged onto ground from a tank

SITE RATED BY E. Repa and C. Furman

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	0	4	0	12
B. Distance to nearest well HAC 4	3	10	30	30
C. Land use/zoning within 1 mile radius	2	3	6	9
D. Distance to reservation boundary	2	6	12	18
E. Critical environments within 1 mile radius of site	0	10	0	30
F. Water quality of nearest surface water body	0	6	0	18
G. Ground water use of uppermost aquifer	3	9	27	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	3	6	18	18
		Subtotals	93	180

Receptors subscore (100 X factor score subtotal/maximum score subtotal) 52

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large) M
2. Confidence level (C = confirmed, S = suspected) C
3. Hazard rating (H = high, M = medium, L = low) H

Factor Subscore A (from 20 to 100 based on factor score matrix) 80

B. Apply persistence factor
Factor Subscore A X Persistence Factor = Subscore B

80 x 1 = 80

C. Apply physical state multiplier

Subscore B X Physical State Multiplier = Waste Characteristics Subscore

80 x 1 = 80

III. PATHWAYS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore _____

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.

1. Surface water migration

Distance to nearest surface water	2	8	16	24
Net precipitation	0	6	0	18
Surface erosion	1	8	8	24
Surface permeability	1	6	6	18
Rainfall intensity	1	8	8	24
		Subtotals	38	108

Subscore (100 X factor score subtotal/maximum score subtotal) 35

2. Flooding

Flooding	0	1	0	0

Subscore (100 x factor score/3) _____

3. Ground-water migration

Depth to ground water	1	8	8	24
Net precipitation	0	6	0	18
Soil permeability	2	8	16	24
Subsurface flows	0	8	0	24
Direct access to ground water	0	8	0	24
		Subtotals	24	114

Subscore (100 x factor score subtotal/maximum score subtotal) 21

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 35

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	52
Waste Characteristics	80
Pathways	35

Total 167 divided by 3 = 56 Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score X Waste Management Practices Factor = Final Score

56 x .95 = 53

FIGURE 2

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE Waste Oil Spreading (Site 13)

LOCATION South of Building 830

DATE OF OPERATION OR OCCURRENCE Mid-1950's to Mid-1960's

OWNER/OPERATOR AFP 44

COMMENTS/DESCRIPTION Site used for spreading of waste oil in dust control practices

SITE RATED BY E. Repa and C. Furman

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	0	4	0	12
B. Distance to nearest well HAC 3	3	10	30	30
C. Land use/zoning within 1 mile radius	2	3	6	9
D. Distance to reservation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	0	10	0	30
F. Water quality of nearest surface water body	0	6	0	18
G. Ground water use of uppermost aquifer	3	9	27	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	3	6	18	18
		Subtotals	99	180

Receptors subscore (100 X factor score subtotal/maximum score subtotal) 55

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large) M
2. Confidence level (C = confirmed, S = suspected) C
3. Hazard rating (H = high, M = medium, L = low) H

Factor Subscore A (from 20 to 100 based on factor score matrix) 80

B. Apply persistence factor
Factor Subscore A X Persistence Factor = Subscore B

80 X 0.8 = 64

C. Apply physical state multiplier

Subscore B X Physical State Multiplier = Waste Characteristics Subscore

64 X 1.0 = 64

III. PATHWAYS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore _____

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.

1. Surface water migration

Distance to nearest surface water	3	8	24	24
Net precipitation	0	6	0	18
Surface erosion	1	8	8	24
Surface permeability	1	6	6	18
Rainfall intensity	1	8	8	24
		Subtotals	46	108
Subscore (100 X factor score subtotal/maximum score subtotal)				43

2. Flooding

Flooding	0	1	0	0
Subscore (100 x factor score/3)				_____

3. Ground-water migration

Depth to ground water	1	8	8	24
Net precipitation	0	6	0	18
Soil permeability	2	8	16	24
Subsurface flows	0	8	0	24
Direct access to ground water	0	8	0	24
		Subtotals	24	114
Subscore (100 x factor score subtotal/maximum score subtotal)				21

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 43

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	55
Waste Characteristics	64
Pathways	43
Total 162 divided by 3 =	54
	Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score X Waste Management Practices Factor = Final Score

54 X .95 = 51

FIGURE 2

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE West Fire Training Area (Site 10)

LOCATION Roadway along a ditch beneath existing holding ponds, west of Bldg. 801

DATE OF OPERATION OR OCCURRENCE Late 1950s

OWNER/OPERATOR AFP 44

COMMENTS/DESCRIPTION Small fires with less than 5 gallons of flammable solvents

SITE RATED BY E. Repa and C. Furman

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	0	4	0	12
B. Distance to nearest well HAC 1, HAC 2, or SC-7	3	10	30	30
C. Land use/zoning within 1 mile radius	2	3	6	9
D. Distance to reservation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	0	10	0	30
F. Water quality of nearest surface water body	0	6	0	18
G. Ground water use of uppermost aquifer	3	9	27	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	3	6	18	18
		Subtotals	99	180

Receptors subscore (100 X factor score subtotal/maximum score subtotal) 55

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large) S
2. Confidence level (C = confirmed, S = suspected) C
3. Hazard rating (H = high, M = medium, L = low) H

Factor Subscore A (from 20 to 100 based on factor score matrix) 60

B. Apply persistence factor
Factor Subscore A X Persistence Factor = Subscore B

60 x 1 = 60

C. Apply physical state multiplier

Subscore B X Physical State Multiplier = Waste Characteristics Subscore

60 x 1 = 60

III. PATHWAYS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore _____

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.

1. Surface water migration

Distance to nearest surface water	3	8	24	24
Net precipitation	0	6	0	18
Surface erosion	1	8	8	24
Surface permeability	1	6	6	18
Rainfall intensity	1	8	8	24
		Subtotals	46	108
Subscore (100 X factor score subtotal/maximum score subtotal)				43

2. Flooding	0	1	0	0
Subscore (100 x factor score/3)				_____

3. Ground-water migration

Depth to ground water	1	8	8	24
Net precipitation	0	6	0	18
Soil permeability	2	8	16	24
Subsurface flows	0	8	0	24
Direct access to ground water	0	8	0	24
		Subtotals	24	114
Subscore (100 x factor score subtotal/maximum score subtotal)				21

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 43

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	55
Waste Characteristics	60
Pathways	43
Total 158 divided by 3 =	53
	Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score X Waste Management Practices Factor = Final Score

53 x .95 = 50

APPENDIX G

GLOSSARY OF TERMINOLOGY AND ABBREVIATIONS

GLOSSARY OF TERMINOLOGY

Alluvial Fan:	A cone-shaped deposit of alluvium made by a stream or river where it runs out onto a level plain or meets a slower stream. Fans generally form where streams or rivers issue from mountains upon the lowland.
Alluvial Terrace:	A terrace resulting from the deposition of sediments by the forces of modern rivers.
Alluvium:	A general term for all detrital deposits resulting from the forces of modern rivers.
Andesite:	A volcanic rock composed essentially of the mineral andesine, and one or more mafic constituents such as pyroxene, hornblende or biotite.
Aquifer:	A geologic formation, group of formations, or part of a formation that is capable of yielding water to a well or spring.
Basalt:	Generally, an extrusive, fine-grained, dark-colored igneous rock composed primarily of calcic plagioclase and pyroxene, with or without olivine.
Basement Rock:	Complex rock, generally of igneous and metamorphic rocks, overlain by sedimentary strata.
Bedrock:	The solid rock underlying auriferous gravel, sand, clay, etc.
Calcareous:	Containing calcium carbonate.
Caliche:	Gravel, sand or desert debris cemented by porous calcium carbonate; also the calcium carbonate itself.
Crystalline Rock:	Rock consisting of minerals in an obviously crystalline state. An inexact general term for igneous and metamorphic rocks as opposed to sedimentary.
Diurnal:	Occurring daily.
Eolian:	Applies to deposits which are due to the transporting action of the wind.
Featheredge:	A very thin stratum or group of strata; generally referring to thicknesses of several tens of feet.
Flood Plain:	The lowland and relatively flat areas adjoining inland and coastal areas of the mainland and off-shore islands, including, at a minimum, areas subject to a one percent or greater chance of flooding in any given year.

Fluvial:	Of, or pertaining to, rivers; produced by river action.
Gneiss:	A course-grained rock in which bands rich in granular minerals alternate with bands in which schistose minerals predominate.
Granite:	A plutonic rock consisting essentially of alkalic feldspar and quartz.
Gypsiferous:	Containing the mineral gypsum.
Groundwater:	Water beneath the land surface in the saturated zone, that is under atmospheric or artesian pressure.
Hazardous Waste:	A solid waste, or combination of solid wastes, which because of its quantity, concentration, physical, chemical, or infectious characteristics may cause or significantly contribute to an increase in mortality or an increase in serious, irreversible, or incapacitating reversible illness; or pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, or disposed of, or otherwise managed.
Hydraulic Conductivity:	The volume of water that will move in unit time under a unit hydraulic gradient through a unit area measured at right angles to the direction of flow.
Igneous Rock:	Rock formed by solidification from a molten or partially molten state; synonomous to "plutonic rock"
Lithology:	The physical character of a rock, generally as determined megascopically or with the aid of a low-power magnifier; the microscopic study and description of rocks.
Loam:	A soil composed of a mixture of clay, silt, sand, and organic matter.
Metamorphic Rock:	Includes all rocks which have formed in the solid state in response to pronounced changes of temperature, pressure, and chemical environment which take place, in general, below the shells of weathering and cementation.
Perched Groundwater:	Groundwater above an impermeable bed underlain by unsaturated rocks of sufficient permeability to allow movement of groundwater.
Permeability:	A rock's capacity for transmitting fluid. Depends upon the size and shape of the rock pores and their interconnection.

Permeate:	Industrial wastewater that has passed through a treatment system for the purpose of lowering the concentrations of toxic constituents to applicable standards; treated wastewater.
Phreatophytic Vegetation:	Deep-rooted plants that obtain their water from the water table or the layer of soil just above it.
Plutonic Rock:	Rock originating from material that formed beneath the earth surface by consolidation from magma.
Potentiometric Surface:	Surface to which water in an aquifer would rise by hydrostatic pressure.
Schist:	A medium- or coarse-grained metamorphic rock with subparallel orientation of the micaceous minerals which dominate its composition.
Solid Waste:	Any garbage, refuse, or sludge from a waste treatment plant, water supply treatment, or air pollution control facility and other discarded material, including solid, liquid, semi-solid, or contained gaseous material resulting from industrial, commercial, mining, or agricultural operations and from community activities; but does not include solid or dissolved materials in irrigation return flows, industrial discharges which are point source subject to permits under Section 402 of the Federal Water Pollution Control Act, as amended (86 USC 880); or source, special nuclear, or by-product material as defined by the Atomic Energy Act of 1954 (68 USC 923).
Transmissivity:	The rate of flow of water through a vertical strip of aquifer one unit wide extending the full saturated thickness of the aquifer under a unit hydraulic gradient.
Tuffaceous:	Pertaining to rocks or sediments formed of volcanic fragments.
Water Table:	An imaginary surface in an unconfined water body at which the water pressure is atmospheric. It is essentially the top of the saturated zone.

GLOSSARY OF ABBREVIATIONS

ADHS	Arizona Department of Health Services
ASDH	Arizona State Department of Health
ADWR	Arizona Department of Water Resources
AF	Air Force
AFB	Air Force Base
AFESC	Air Force Engineering and Services Center
AFP	Air Force Plant
AFPRO	Air Force Plant Representative Office
AFSC	Air Force Systems Command
AIM	Air Intercept Missile
AMRAAM	Advanced Medium Range Air-to-Air Missile
ASD	Aeronautical Systems Division
bls	below land surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
DCE	1,1-Dichloroethylene
DEQPPM	Defense Environmental Quality Program Policy Memorandum
DOD	Department of Defense
°F	Degrees Fahrenheit
FACO	Final Assembly and Checkout
FIT	Field Investigation Team
ft^2	Square feet
GIW	General Industrial Wastewater
gpd	gallons per day
HAC, Hughes	Hughes Aircraft Company
HARM	Hazard Assessment Rating Methodology

IRP	Installation Restoration Program
MEK	Methyl Ethyl Ketone
mgd	million gallons per day
msl	mean sea level
NCP	National Contingency Plan
NOAA	National Oceanic and Atmospheric Administration
N.O.S.	Not Otherwise Specified
PCB	Polychlorinated biphenyls
PCHD	Pima County Health Department
ppb	parts per billion
ppm	parts per million
RCRA	Resource Conservation and Recovery Act
SCS	Soil Conservation Service
TAA	Tucson Airport Authority
TAC	Tucson Aviation Center
TCA	1,1,1-Trichloroethane
TCE	Trichloroethylene
TIA	Tucson International Airport
TOC	Total Organic Carbon
TOW	Tracked Optically, Wire-Guided (Missile)
TWD	Tucson Water Department
U.S. EPA	United States Environmental Protection Agency
USGS	United States Geological Survey
VOC	Volatile Organic Compounds
WWTP	Wastewater Treatment Plant

APPENDIX H

SUPPLEMENTAL SITE INFORMATION

PROCESS TANK LIST

LOCATION	PROCESS LINE	STN NO.	APPLICATION	OPERATING CAPACITY GALLONS	CONSTITUENTS	CONCENTRATION	TEMPERATURE	RENEWAL FREQUENCY
PLATING SHOP	CHEM COAT ALUM.	2, 3	ALKALINE CLEANER	700	"ALDET"	4.5% WT	180°F	YEARLY
PLATING SHOP	CHEM. COAT. ALUM.	4	RINSE	350	WATER	100%	AMBIENT	
PLATING SHOP	CHEM. COAT. ALUM.	5, 6	DEOXIDIZER	700	"ALDOX"	11% WT	AMBIENT	6 MONTHS
PLATING SHOP	CHEM. COAT. ALUM.	7	RINSE	350	WATER	100%	AMBIENT	
PLATING SHOP	CHEM. COAT. ALUM.	8	CONVERSION COATING, ALUM.	350	"ALODINE 1200"	1.1% WT.	AMBIENT	AS REQ
PLATING SHOP	CHEM. COAT. ALUM.	9	RINSE	350	WATER	100%	AMBIENT	
PLATING SHOP	CHEM. COAT. ALUM.	10	HOT RINSE	350	WATER	100%	150°F	
PLATING SHOP	CHEM. COAT. ALUM.	11	HOT AIR DRYER					
PLATING SHOP	CHROME PLATE LINE	-	CHROME ETCH	168	CHROMIC ACID FLAKE	14% WT.	AMBIENT	AS REQ.
PLATING SHOP	CHROME PLATE LINE	-	CHROME PLATE	450	CHROMIC ACID FLAKE SULFURIC ACID	25% WT. 0.1% VOL.	130°F	AS REQ.
PLATING SHOP	CHROME PLATE LINE	-	RINSE	130	WATER	100%	AMBIENT	AS REQ.
PLATING SHOP	CHROME PLATE LINE	-	ALKALINE STRIPPER	120	SODIUM HYDROXIDE SODIUM CARBONATE	6% WT. 7% WT.	AMBIENT	YEARLY
PLATING SHOP	CHROME PLATE LINE	-	RINSE	130	WATER	100%	AMBIENT	
PLATING SHOP	10 FT. ANODIZE	3	ALKALINE CLEANER	870	"ALDET"	4.5% WT.	180°F	YEARLY
PLATING SHOP	10 FT. ANODIZE	4	RINSE	870	WATER	100%	AMBIENT	
PLATING SHOP	10 FT. ANODIZE	5	DEOXIDIZER ALUMINUM	870	"ALDOX"	11% WT.	AMBIENT	6 MONTHS
PLATING SHOP	10 FT. ANODIZE	6	RINSE	870	WATER	100%	AMBIENT	
PLATING SHOP	10 FT. ANODIZE	7	CONVERSION COATING, ALUM	870	"ALODINE 1200"	1.1% WT.	AMBIENT	AS REQ.
PLATING SHOP	10 FT. ANODIZE	8	ANODIZE, TYPE II	870	SULFURIC ACID	10% VOL.	70°F	AS REQ
PLATING SHOP	10 FT. ANODIZE	9	ANODIZE, TYPE III	870	SULFURIC ACID	15% VOL.	40°F	AS REQ.
PLATING SHOP	10 FT. ANODIZE	10	RINSE	870	WATER	100%	AMBIENT	AS REQ
PLATING SHOP	10 FT. ANODIZE	11	CHROMIC ACID ANODIZE	870	CHROMIC ACID	4.7% WT	95°F	AS REQ
PLATING SHOP	10 FT. ANODIZE	12	RINSE	870	WATER	100%	AMBIENT	AS REQ
PLATING SHOP	10 FT. ANODIZE	13	DYE, BLACK	870	ALUMINUM DEEP BLACK MLW	1.1% WT.	150°F	6 MONTHS
PLATING SHOP	10 FT. ANODIZE	14	DYE, OLIVE DRAB	870	SOLOPHENYL OLIVE GL EX #16364 SODIUM ACETATE ACETIC ACID	0.026% WT 0.1% WT. 0.0035% WT	120°F	MONTHLY
PLATING SHOP	10 FT. ANODIZE	15	RINSE	870	WATER	100%	AMBIENT	
PLATING SHOP	10 FT. ANODIZE	16	NICKEL ACETATE SEAL	870	"ALCOR"	1.2% WT.	195°F	6 MONTHS

PROCESS TANK LIST

HUGHES AIRCRAFT COMPANY — WATER POLLUTION

LOCATION TUCSON, AZ PROJECT CONTROL STUDY

COMP DJH CHK REH APP HMB

WILSON & COMPANY ENGINEERS & ARCHITECTS
SALINA ATLANTA ALBUQUERQUE

FILE 71 1904

DATE FEB 1973

SHEET 1 / 9

LOCATION	PROCESS LINE	STN NO.	APPLICATION	OPERATING CAPACITY GALLONS	CONSTITUENTS	CONCENTRATION	TEMPERATURE	RENEWAL FREQUENCY
PLATING SHOP	10 FT ANODIZE	17	HOT AIR DRYER	-	-	-	-	-
PLATING SHOP	AUTO PHOSPHATE SYS	2	INACTIVE	-	-	-	190°F	YEARLY
PLATING SHOP	AUTO PHOSPHATE SYS	3	INACTIVE	-	-	100%	AMBIENT	
PLATING SHOP	AUTO PHOSPHATE SYS.	4	ACID DIP	350	"PHOSPHOTEX M 760"	-	-	-
PLATING SHOP	AUTO PHOSPHATE SYS	5	INACTIVE	-	-	-	-	-
PLATING SHOP	AUTO PHOSPHATE SYS.	6	RINSE	350	WATER	100%	AMBIENT	
PLATING SHOP	AUTO PHOSPHATE SYS.	7, 8	ZINC PHOSPHATE	700	"PHOSPHOTEX A-8" "PHOSPHOTEX B-1"	3% VOL 1% VOL	205°F	AS REQ
PLATING SHOP	AUTO PHOSPHATE SYS.	9	RINSE	350	WATER	100%	AMBIENT	
PLATING SHOP	AUTO PHOSPHATE SYS.	10	SEALER	350	"PHOSPHOTEX M572"	0.125% VOL	200°F	
PLATING SHOP	AUTO PHOSPHATE SYS.	11	HOT AIR DRY	-	-	-	-	-
PLATING SHOP	4 FT ANODIZE	2	ALKALINE CLEAN	350	"ALDET"	4.5% WT	175°F	YEARLY
PLATING SHOP	4 FT ANODIZE	3	RINSE	350	WATER	100%	AMBIENT	
PLATING SHOP	4 FT. ANODIZE	4	DEOXIDIZER ALUMINUM	350	"ALOOX"	9.8% WT	AMBIENT	6 MONTHS
PLATING SHOP	4 FT. ANODIZE	5	RINSE	350	WATER	100%	AMBIENT	
PLATING SHOP	4 FT. ANODIZE	6	ANODIZE, TYPE II	350	SULFURIC ACID	10% VOL	70°F	YEARLY
PLATING SHOP	4 FT. ANODIZE	7	ANODIZE, TYPE II	350	SULFURIC ACID	10% VOL	70°F	YEARLY
PLATING SHOP	4 FT. ANODIZE	8	ANODIZE, TYPE II	350	SULFURIC ACID	10% VOL	70°F	YEARLY
PLATING SHOP	4 FT. ANODIZE	9	ANODIZE, TYPE III	350	SULFURIC ACID	13.8% VOL	40°F	YEARLY
PLATING SHOP	4 FT. ANODIZE	10	RINSE	350	WATER	100%	AMBIENT	
PLATING SHOP	4 FT. ANODIZE	11	TRANSFER STAND	-	-	-	-	-
PLATING SHOP	4 FT. ANODIZE	12	DYE, BLACK	365	ALUMINUM DEEP BLACK MLD	4.1% WT	150°F	6 MONTHS
PLATING SHOP	4 FT. ANODIZE	13	RINSE	350	WATER	100%	AMBIENT	
PLATING SHOP	4 FT. ANODIZE	14	DYE, OLIVE DRAB	360	SOLOPHENYL OLIVE GL EX #16304 SODIUM ACETATE ACETIC ACID	0.025% WT. 0.1% WT. 0.004% VOL.	175°F	MONTHLY
PLATING SHOP	4 FT. ANODIZE	15	RINSE	350	WATER	100%	AMBIENT	
PLATING SHOP	4 FT. ANODIZE	16	CHROMIC ACID SEAL	350	WATER	-	-	-
PLATING SHOP	4 FT. ANODIZE	17	NICKEL ACETATE SEAL	350	"ALCOR"	1.2% WT.	190°F	6 MONTHS
PLATING SHOP	4 FT. ANODIZE	18	DRYER	-	-	-	-	-

PROCESS TANK LIST

HUGHES AIRCRAFT COMPANY — WATER POLLUTION CONTROL STUDY

LOCATION TUCSON AZ PROJECT

COMP DJB CHK RLB APP MMB

WILSON EQUIPMENT ENGINEERS & PLANNERS
SALINA ATLANTA ALBUQUERQUE

FILE 71-1908

DATE FEB. 1973

SHEET 7 / 9

LOCATION	PROCESS LINE	SEN. NO.	APPLICATION	OPERATING CAPACITY GALLONS	CONSTITUENTS	CONCENTRATION	TEMPERATURE	RENEWAL FREQUENCY
PLATING SHOP	PRECIOUS METAL LINE	-	SILVER STRIKE	95	POTASSIUM CYANIDE POTASSIUM CARBONATE POTASSIUM SILVER CYANIDE	7.14% WT. 1.58% WT. 0.76% WT.	AMBIENT	AS REQ.
PLATING SHOP	PRECIOUS METAL LINE	-	SILVER PLATE	95	POTASSIUM CYANIDE POTASSIUM CARBONATE SILVER CYANIDE "SILVERGLOSS BRIGHTENER #1001" "SILVERGLOSS ADDITIVE #1001A"	12% WT. 1.4% WT. 4.5% WT. 3.03% VOL. 0.64% VOL.	AMBIENT	AS REQ.
PLATING SHOP	PRECIOUS METAL LINE	-	WATER RINSE	-	WATER	100%	AMBIENT	
PLATING SHOP	PRECIOUS METAL LINE	-	GOLD STRIKE	16	"ACR CONDUCTOR SALT" "ACR pH CP PHOSPHORIC ACID" "ACR 24K GOLD SALT"	11.25% WT 1.03% VOL. 0.82% WT.	AMBIENT	AS REQ
PLATING SHOP	PRECIOUS METAL LINE	-	RINSE	-	WATER	100%	AMBIENT	
PLATING SHOP	PRECIOUS METAL LINE	-	GOLD PLATE	16	"ACR P-200 CONDUCTOR SALT" "ACR P-200 BRIGHTENER" "ACR P-200 GOLD SALT"	18% WT 9.3% VOL. 1.03% WT.	AMBIENT	AS REQ
PLATING SHOP	PRECIOUS METAL LINE	-	WATER RINSE	-	WATER	100%	AMBIENT	
PLATING SHOP	PRECIOUS METAL LINE	-	CHEMICAL BLACKENING	130	"EBONOL 'C' SPECIAL	18% WT	200°F	MONTHLY
PLATING SHOP	PRECIOUS METAL LINE	-	RINSE	-	WATER	100%	AMBIENT	
PLATING SHOP	PRECIOUS METAL LINE	-	STRIPPER	58	SULFURIC ACID GLYCERINE	5?% WT. 3% VOL.	AMBIENT	YEARLY
PLATING SHOP	CADMIUM PLATE LINE	-	ALKALINE CLEANER	220	"OAKITE #90"	9% WT.	150°F	3 MONTHS
PLATING SHOP	CADMIUM PLATE LINE	-	RINSE	130	WATER	100%	AMBIENT	
PLATING SHOP	CADMIUM PLATE LINE	-	ACID DIP	130	MURIATIC ACID	10% VOL	AMBIENT	2 WEEKS
PLATING SHOP	CADMIUM PLATE LINE	-	RINSE	130	WATER	100%	AMBIENT	
PLATING SHOP	CADMIUM PLATE LINE	-	NICKEL CHLORIDE STRIKE	242	NICKEL CHLORIDE HYDROCHLORIC ACID	24% WT. 4.7% VOL.	AMBIENT	AS REQ
PLATING SHOP	CADMIUM PLATE LINE	-	RINSE	130	WATER	100%	AMBIENT	

PROCESS TANK LIST

HUGHES AIRCRAFT COMPANY — WATER POLLUTION

LOCATION TUCSON, AZ. PROJECT CONTROL STUDY

COMP BIB CHK REH APP MHB

WILSON & COMPANY ENGINEERS & ARCHITECTS
SALINA ATLANTA ALBUQUERQUE

FILE 71-190A

DATE FEB. 1973

SHEET 3 / 9

LOCATION	PROCESS LINE	STN. NO.	APPLICATION	OPERATING CAPACITY GALLONS	CONSTITUENTS	CONCENTRATION	TEMPERATURE	RENEWAL FREQUENCY
PLATING SHOP	CADMIUM PLATE LINE	-	CADMIUM PLATE	470	CADMIUM OXIDE SODIUM CYANIDE "RONCO SUPER 'XL' BRIGHTENER	2.55% WT. 12% WT. 0.16% VOL.	AMBIENT	AS REQ.
PLATING SHOP	CADMIUM PLATE LINE	-	RINSE	130	WATER	100%	AMBIENT	
PLATING SHOP	CADMIUM PLATE LINE	-	BRIGHT DIP	165	SULFURIC ACID HYDROGEN PEROXIDE	0.28% VOL. 2.1% VOL.	AMBIENT	6 MONTHS
PLATING SHOP	CADMIUM PLATE LINE	-	CONVERSION COATING, CAD	107	"IRIDITE BLUERITE #8"	1.24% VOL.	AMBIENT	AS REQ.
PLATING SHOP	CADMIUM PLATE LINE	-	RINSE	130	WATER	100%	AMBIENT	
PLATING SHOP	CADMIUM PLATE LINE	-	COPPER PLATE	415	COPPER CYANIDE SODIUM CYANIDE SODIUM CARBONATE ROCHELLE SALTS	4.2% WT. 4.9% WT. 2.9% WT. 5.6% WT.	150°F	AS REQ.
PLATING SHOP	CADMIUM PLATE LINE	-	RINSE	130	WATER	100%	AMBIENT	
PLATING SHOP	CADMIUM PLATE LINE	-	AMMONIUM NITRATE DIP	130	SULFURIC ACID	10% VOL.	AMBIENT	AS REQ.
PLATING SHOP	CADMIUM PLATE LINE	-	TINTILATE	147	STANNOUS SULFATE SULFURIC ACID "RENVERT STARTER" "RENVERT BRIGHTENER"	3% WT. 10% VOL. 7.9% VOL. 1.1% VOL.	50°F	AS REQ.
PLATING SHOP	CADMIUM PLATE LINE	-	RINSE	130	WATER	100%	AMBIENT	
PLATING SHOP	CADMIUM PLATE LINE	-	NICKEL PLATE	120	NICKEL SULFATE NICKEL CHLORIDE BORIC ACID "NOVA #10" "NOVA #30" "NOVA #45" "NOVA #20"	30% WT. 11.25% WT. 5% WT. 4.5% VOL 1.5% VOL. 0.25% VOL. 0.05% VOL.	130°F	AS REQ.
PLATING SHOP	ZINCATING LINE	-	ALKALINE CLEANER	435	"ALDET"	3.75% WT.	170°F	YEARLY
PLATING SHOP	ZINCATING LINE	-	RINSE	435	WATER	100%	AMBIENT	
PLATING SHOP	ZINCATING LINE	-	ETCH, ALUMINUM	435	AMMONIUM BIFLUORIDE SULFURIC ACID	4.9% WT. 1.95% VOL.	AMBIENT	MONTHLY
PLATING SHOP	ZINCATING LINE	-	RINSE	435	WATER	100%	AMBIENT	

PROCESS TANK LIST

HUGHES AIRCRAFT COMPANY — WATER POLLUTION CONTROL STUDY

LOCATION TUCSON, AZ PROJECT

COMP BMI CHK BEB APP HMB

WILSON & COMPANY
ENGINEERS & ARCHITECTS
SALINA
ATLANTA
ALBUQUERQUE

FILE 11-150A

DATE FEB. 1973

SHEET 4 / 9

LOCATION	PROCESS LINE	STN. NO	APPLICATION	OPERATING CAPACITY GALLONS	CONSTITUENTS	CONCENTRATION	TEMPERATURE	RENEWAL FREQUENCY
PLATING SHOP	ZINCATING LINE	-	SMUT REMOVER	435	NITRIC ACID	35% VOL.	AMBIENT	MONTHLY
PLATING SHOP	ZINCATING LINE	-	RINSE	435	WATER	100%	AMBIENT	
PLATING SHOP	ZINCATING LINE	-	ZINCATE, COPPER STRIKE	435	"ALUMON 'D'"	12% WT.	AMBIENT	
PLATING SHOP	ZINCATING LINE	-	WATER RINSE	435	WATER	100%	AMBIENT	
PLATING SHOP	ZINCATING LINE	-	COPPER STRIKE	435	COPPER CYANIDE SODIUM CYANIDE ROCHELLE SALTS SODIUM CARBONATE	-	130°F	AS REQ
PLATING SHOP	ZINCATING LINE	-	RINSE	435	WATER	100%	AMBIENT	
PLATING SHOP	ELECTRODELESS NICKEL	-	RINSE	130	D.I. WATER	100%	AMBIENT	
PLATING SHOP	ELECTRODELESS NICKEL	-	ELECTRODELESS NICKEL	250	"ELEC. NICKEL CONC. NL-67"	20% VOL	190°F	AS REQ
PLATING SHOP	ELECTRODELESS NICKEL	-	ELECTRODELESS NICKEL STORAGE	250	"ELEC. NICKEL CONC. NL-67"	20% VOL.	AMBIENT	AS REQ.
PLATING SHOP	ELECTRODELESS NICKEL	-	ELECTRODELESS NICKEL	250	"ELEC. NICKEL CONC. NL-67"	20% VOL.	190°F	AS REQ.
PLATING SHOP	ELECTRODELESS NICKEL	-	RINSE	150	D.I. WATER	100%	AMBIENT	
PLATING SHOP	S. METAL FINISHING	-	ETCH CLEANER, ALUM.	430	SODIUM DICHROMATE	5.6% WT.	150°F	6 WEEKS
PLATING SHOP	S. METAL FINISHING	-	RINSE	435	WATER	100%	AMBIENT	
PLATING SHOP	S. METAL FINISHING	-	RINSE	435	D.I. WATER	100%	AMBIENT	
PLATING SHOP	S. METAL FINISHING	-	ALKALINE CLEANER	180	"WYANDOTTE #90"	9% WT.	200°F	MONTHLY
PLATING SHOP	S. METAL FINISHING	-	CAUSTIC PERMANGANATE	155	"DIVERSEY #299"	11.8% WT.	200°F	YEARLY
PLATING SHOP	S. METAL FINISHING	-	RINSE	155	WATER	100%	AMBIENT	
PLATING SHOP	S. METAL FINISHING	-	ACID BRIGHT DIP	155	"DIVERSEY DS-9-33"	100%	AMBIENT	AS REQ
PLATING SHOP	S. METAL FINISHING	-	RINSE	155	WATER	100%	AMBIENT	
PLATING SHOP	S. METAL FINISHING	-	NITRIC-SULFURIC DIP	155	"DIVERSEY EVERITE #30"	48% VOL	AMBIENT	YEARLY
PLATING SHOP	S. METAL FINISHING	-	PASSIVATE	365	NITRIC ACID SODIUM DICHROMATE	13.95% VOL 2.06% WT.	130°F	YEARLY
PLATING SHOP	S. METAL FINISHING	-	RINSE	130	WATER	100%	AMBIENT	
PLATING SHOP	S. METAL FINISHING	-	ALKALINE CLEANER	130	"ALDET"	6.9% WT.	185°F	YEARLY
PLATING SHOP	S. METAL FINISHING	-	SMUT REMOVER	170	NITRIC ACID	35% VOL	AMBIENT	WEEKLY
PLATING SHOP	S. METAL FINISHING	-	RINSE	130	WATER	100%	AMBIENT	

PROCESS TANK LIST

LOCATION: HUGHES AIRCRAFT COMPANY TUCSON, AZ — PROJECT: WATER POLLUTION CONTROL STUDY

COMP DIM CHK REV APP MMB

WILSON & COMPANY ENGINEERS & ARCHITECTS
SALINA ATLANTA ALBUQUERQUE

FILE 71 1908
DATE FEB. 1973
SHEET 5 / 8

LOCATION	PROCESS LINE	STN. NO	APPLICATION	OPERATING CAPACITY GALLONS	CONSTITUENTS	CONCENTRATION	TEMPERATURE	RENEWAL FREQUENCY
PLATING SHOP	S. METAL FINISHING	-	ALUMINUM ETCH	32	NITRIC ACID HYDROFLUORIC ACID	43.75% VOL 5.83% VOL.	AMBIENT	WEEKLY
PLATING SHOP	S. METAL FINISHING	-	CONVERSION COATING, STEEL	325	"BLACK MAGIC SALTS"	12% WT	290°F	AS REQ.
PLATING SHOP	S. METAL FINISHING	-	HOT RINSE	120	WATER	100%	170°F	
PLATING SHOP	S. METAL FINISHING	-	ACID PICKLE	165	MURIATIC ACID	19% VOL.	AMBIENT	MONTHLY
PLATING SHOP	S. METAL FINISHING	-	RINSE	165	WATER	100%	AMBIENT	
PLATING SHOP	S. METAL FINISHING	-	COPPER STRIP	165	CHROMIC ACID FLAKE SULFURIC ACID	48% WT. 2.95% VOL.	AMBIENT	AS REQ
PLATING SHOP	-	-	VAPOR DEGREASER	-	1,1,1, TRICHLOROETHANE	100%	165°F	AS REQ.
PLATING SHOP	-	-	VAPOR DEGREASER	-	1,1,1, TRICHLOROETHANE	100%	165°F	AS REQ.
ETCH CIRCUITRY	COPPER SOLDER PLATING SYSTEM	3	RINSE	120	WATER	100%	150°F	AS REQ.
ETCH CIRCUITRY	COPPER SOLDER PLATING SYSTEM	4, 5	SOLDER PLATE	350	BORIC ACID LEAD FLUOBORATE STANNOUS FLUOBORATE FLUOBORIC ACID PEPTONE SOL. STAB.	1.9% WT. 5.5% WT. 13.7% WT. 12.3% WT 1.7% VOL		AS REQ.
ETCH CIRCUITRY	COPPER SOLDER PLATING SYSTEM	6	ACID PICKLE	110	FLUOBORIC ACID	5.7% VOL	AMBIENT	4 WEEKS
ETCH CIRCUITRY	COPPER SOLDER PLATING SYSTEM	7	RINSE	120	WATER	100%	AMBIENT	
ETCH CIRCUITRY	COPPER SOLDER PLATING SYSTEM	8	DEOXIDIZER	110	SULFURIC ACID	11.3% VOL.		4 WEEKS
ETCH CIRCUITRY	COPPER SOLDER PLATING SYSTEM	9	ALKALINE CLEANER	110	"WYANDOTTE #90"	7% WT.	150°F	4 WEEKS
ETCH CIRCUITRY	COPPER SOLDER PLATING SYSTEM	10	RINSE	60	WATER	100%	150°F	
ETCH CIRCUITRY	COPPER SOLDER PLATING SYSTEM	11	RINSE	60	WATER	100%	AMBIENT	
ETCH CIRCUITRY	COPPER SOLDER PLATING SYSTEM	12	ETCH, COPPER	110	"METEX PTH ETCH G-2"	14.2% WT.	AMBIENT	WEEKLY
ETCH CIRCUITRY	COPPER SOLDER PLATING SYSTEM	13	RINSE	120	WATER	100%	AMBIENT	
ETCH CIRCUITRY	COPPER SOLDER PLATING SYSTEM	14	DEOXIDIZER	110	SULFURIC ACID	11.3% VOL	AMBIENT	4 WEEKS
ETCH CIRCUITRY	COPPER SOLDER PLATING SYSTEM	15	RINSE	120	WATER	100%	AMBIENT	
ETCH CIRCUITRY	COPPER SOLDER PLATING SYSTEM	16, 17, 18, 19	COPPER PLATE	700	"M & T LIQUID C-11-X8" "M & T LIQUID C-10-X8" AMMONIUM HYDROXIDE "M & T ADDITION AGT PY-61-H	3.5% VOL. 33% VOL. 0.43% VOL. 0.09% VOL.	125°F	AS REQ.
ETCH CIRCUITRY	COPPER SOLDER PLATING SYSTEM	20	RINSE	120	WATER	100%		

PROCESS TANK LIST

HUGHES AIRCRAFT COMPANY — WATER POLLUTION CONTROL STUDY

LOCATION TUCSON, AZ. PROJECT

COMP DIB CHK REN APP MHB

WILSON & COMPANY
ENGINEERS & ARCHITECTS
SALINA ATLANTA ALBUQUERQUE

FILE 71 190A

DATE FEB. 1973

SHEET 6 / 9

LOCATION	PROCESS LINE	STN NO	APPLICATION	OPERATING CAPACITY GALLONS	CONSTITUENTS	CONCENTRATION	TEMPERATURE	RENEWAL FREQUENCY
ETCH CIRCUITRY	COPPER SOLDER PLATING SYSTEM	21,22,23,24	COPPER PLATE	700	"M & T LIQUID C-11-XB" "M & T LIQUID C-10-XB" AMMONIUM HYDROXIDE "M & T ADDITION AGENT PY-61-M"	3.5% VOL. 33% VOL 0.43% VOL. 0.09% VOL.		
ETCH CIRCUITRY	ELECTRODELESS COPPER	3	RINSE	120	WATER	100%	150°F	
ETCH CIRCUITRY	ELECTRODELESS COPPER	4	DEOXIDIZER	60	SULFURIC ACID	9.8% VOL.	AMBIENT	4 WEEKS
ETCH CIRCUITRY	ELECTRODELESS COPPER	5	RINSE	-	WATER	100%	AMBIENT	
ETCH CIRCUITRY	ELECTRODELESS COPPER	6	CLEANER-CONDITIONER	60	"1175 CONDITIONER"	2.5% VOL.	AMBIENT	4 WEEKS
ETCH CIRCUITRY	ELECTRODELESS COPPER	7	RINSE	60	WATER	100%	AMBIENT	
ETCH CIRCUITRY	ELECTRODELESS COPPER	8	RINSE	60	WATER	100%	AMBIENT	
ETCH CIRCUITRY	ELECTRODELESS COPPER	9	RINSE	60	WATER	100%	AMBIENT	
ETCH CIRCUITRY	ELECTRODELESS COPPER	10	AMMONIUM PERSULFATE ETCH	60	AMMONIUM PERSULFATE SULFURIC ACID	9% WT 0.64% VOL.	90°F	MON., WED & FRI.
ETCH CIRCUITRY	ELECTRODELESS COPPER	11	RINSE	60	WATER	100%	AMBIENT	
ETCH CIRCUITRY	ELECTRODELESS COPPER	12	RINSE	60	WATER	100%	AMBIENT	
ETCH CIRCUITRY	ELECTRODELESS COPPER	13	RINSE	60	WATER	100%	AMBIENT	
ETCH CIRCUITRY	ELECTRODELESS COPPER	14	DEOXIDIZE	60	SULFURIC ACID	9.8% VOL.	AMBIENT	4 WEEKS
ETCH CIRCUITRY	ELECTRODELESS COPPER	15	CLEANER	60	HYDROCHLORIC ACID	9.5% VOL.	AMBIENT	
ETCH CIRCUITRY	ELECTRODELESS COPPER	16	CATYLIST	60	HYDROCHLORIC ACID "CATYLIST 9F"	9.5% VOL. 25% VOL.	AMBIENT	
ETCH CIRCUITRY	ELECTRODELESS COPPER	17	RINSE	60	WATER	100%	AMBIENT	
ETCH CIRCUITRY	ELECTRODELESS COPPER	18	RINSE	60	WATER	100%	AMBIENT	
ETCH CIRCUITRY	ELECTRODELESS COPPER	19	RINSE	60	WATER	100%	AMBIENT	
ETCH CIRCUITRY	ELECTRODELESS COPPER	20	ACCELERATOR	60	"ACCELERATOR #19"	16.7% VOL	AMBIENT	4 WEEKS
ETCH CIRCUITRY	ELECTRODELESS COPPER	21	RINSE	60	WATER	100%	AMBIENT	
ETCH CIRCUITRY	ELECTRODELESS COPPER	22	RINSE	60	WATER	100%	AMBIENT	
ETCH CIRCUITRY	ELECTRODELESS COPPER	23	RINSE	60	WATER	100%	AMBIENT	
ETCH CIRCUITRY	ELECTRODELESS COPPER	24	ELECTRODELESS COPPER PLATE	90	"CP-70-A" "CP-70-B" "CP-70-Z"		125°F	AS REQ

PROCESS TANK LIST

LOCATION: HUGHES AIRCRAFT COMPANY TUCSON, AZ

PROJECT: WATER POLLUTION CONTROL STUDY

COMP BJB CHK REH APP HHD

WILSON & COMPANY ENGINEERS & ARCHITECTS SALINA ATLANTA ALBUQUERQUE

FILE 71 190A

DATE FEB. 1973

SHEET 7 / 9

LOCATION	PROCESS LINE	STN NO	APPLICATION	OPERATING CAPACITY GALLONS	CONSTITUENTS	CONCENTRATION	TEMPERATURE	RENEWAL FREQUENCY
ETCH CIRCUITRY	ELECTRODELESS COPPER	25	ELECTRODELESS COPPER PLATE	90	"CP-70-A" "CP-70-M" "CP-70-Z"		125°F	AS REQ
ETCH CIRCUITRY	SOUTH PLATING L.	-	RINSE, SPRAY	-	D I WATER	100%		
ETCH CIRCUITRY	SOUTH PLATING L.	-	RINSE, HOT SPRAY	-	D.I. WATER	100%		
ETCH CIRCUITRY	SOUTH PLATING L.		SOLDER REFLOW AGENT	50 LBS	"CARBOWAX 4000" "BISPHENOL A"	96%		AS REQ.
ETCH CIRCUITRY	SOUTH PLATING L	-	CHEMCUT ETCHER	75	CHROMIC - SULFURIC ACID	90%		
ETCH CIRCUITRY	SOUTH PLATING L.	-	ALKALINE CLEANER	60	"ALDET"		150°F	WEEKLY
ETCH CIRCUITRY	SOUTH PLATING L.	-	ACID DIP	18	HYDROCHLORIC ACID	25%		WEEKLY
ETCH CIRCUITRY	SOUTH PLATING L.	-	RINSE	18	WATER	100%	AMBIENT	AS REQ.
ETCH CIRCUITRY	SOUTH PLATING L.	-	BRIGHTENER	18	"SOLDER BRIGHT SOLUTION"	100%	AMBIENT	WEEKLY
ETCH CIRCUITRY	SOUTH PLATING L.	-	RINSE	18	WATER	100%	AMBIENT	
ETCH CIRCUITRY	SOUTH PLATING L.	-	RINSE	18	D I WATER	100%	AMBIENT	
ETCH CIRCUITRY	SOUTH PLATING L.	-	NICKEL PLATE	80	NICKEL SULFAMATE		120°F	AS REQ.
ETCH CIRCUITRY	SOUTH PLATING L.	-	RINSE	18	WATER	100%		
ETCH CIRCUITRY	SOUTH PLATING L	-	GOLD PLATE	30	"OROSENE PC MAKE-UP #1" "OROSENE PC MAKE-UP #2" "OROSENE DC SALTS	12% VOL 6.6% VOL. 0.82% WT.	100°F	
ETCH CIRCUITRY	SOUTH PLATING L.	-	RINSE	18	WATER	100%		
ETCH CIRCUITRY	-	-	CIRCUIT BOARD SCRUBBER	100	TRICHLORDETHYLENE			
ETCH CIRCUITRY	-	-	PUMICE TANK	50	PUMICE	25% VOL		
ETCH CIRCUITRY	-	-	CKT. BRD VAPOR BLASTER	80	ALUMINUM OXIDE #325	25 VOL		
ETCH CIRCUITRY	-	-	ARGUS REFLOW M C	-	WATER SPRAY		140°F	
ETCH CIRCUITRY	-	-	CIRCUIT BOARD ETCHER	80	NEUTRA ETCH	100%	125°F	AS REQ.
ETCH CIRCUITRY	-	-	CIRCUIT BOARD STRIPPER	12	METHALENE CHLORIDE	100%	AMBIENT	AS REQ.
ETCH CIRCUITRY	-	-	ETCH BACK CONSOLE	777	CHROMIC - HCL - HF	100-20-20	150°F	AS REQ.
ETCH CIRCUITRY	YELLOW ROOM	-	RESIST PROCESSOR		1,1,1 TRICHLORDETHANE	100%	60-70°F	AS REQ.
BUILDING 1	SPOTWELD AREA	-	ALKALINE CLEANER	115	"RIDOLINE 322"	3.1% WT	160°F	6 MONTHS

PROCESS TANK LIST

HUGHES AIRCRAFT COMPANY — WATER POLLUTION CONTROL STUDY

LOCATION TUCSON, AZ. PROJECT

COMP DIR CHK REM APP INIT

WILSON & COMPANY
SALINA ATLANTA ALBUQUERQUE

FILE 71 1904

DATE FEB. 1973

SHEET 8 / 9

LOCATION	PROCESS LINE	STN. NO	APPLICATION	OPERATING CAPACITY GALLONS	CONSTITUENTS	CONCENTRATION	TEMPERATURE	REMOVAL FREQUENCY
BUILDING 1	SPOT WELD AREA	-	DEOXIDIZER, ALUMINUM	155	ANCHEM DEOXIDIZE #7 SULFURIC ACID	2.3% WT. 4.75% VOL.	AMBIENT AMBIENT	6 MONTHS AS REQ.
BUILDING 1	SPOT WELD AREA	-	VAPOR DEGREASER	60	TRICHLORDETHYLENE	100%	190°F	2 MONTHS
BUILDING 1	HEAT TREAT	-	BRINE QUENCH #27	435	SODIUM CHLORIDE	10 G% WT	AMBIENT	6 MONTHS
BUILDING 1	HEAT TREAT	-	BRINE QUENCH #13	270	SODIUM CHLORIDE	10 G% WT.	AMBIENT	6 MONTHS
BUILDING 1	HEAT TREAT	-	DEEP FREEZE #35	300	SYNASOL SOLVENT	100%	-120°F	AS REQ
BUILDING 1	HEAT TREAT	-	VAPOR DEGREASER	250	TRICHLORDETHYLENE	100%	165°F	2 MONTHS
BUILDING 1	TOW FABRIC AREA	-	INACTIVE					
BUILDING 1	DUST FREE AREA	-	VAPOR DEGREASER	24	TRICHLORDETHYLENE	100%	165°F	2 MONTHS
BUILDING 1	TOW ASSY AREA	-	VAPOR DEGREASER D-19	185	1,1,1 TRICHLORDETHANE	100%	165°F	AS REQ.
BUILDING 1	CENTRAL ASSY.	-	VAPOR DEGREASER M-18	46	TRICHLOROTRIFLUORDETHANE	100%	165°F	AS REQ.
BUILDING 1	CENTRAL ASSY	-	VAPOR DEGREASER M-20	185	1,1,1 TRICHLORDETHANE	100%	165°F	AS REQ.
BUILDING 1	PHOENIX ASSY.	-	VAPOR DEGREASER 1-23	61	1,1,1 TRICHLORDETHANE	100%	165°F	AS REQ.
BUILDING 1	DIGITIL DRILL	-	VAPOR DEGREASER	46	FREON TE	100%	108°F	AS REQ.
BUILDING 30	WELDING SHOP	-	VAPOR DEGREASER	110	TRICHLORDETHYLENE	100%	165°F	MONTHLY
BUILDING 30	WELDING SHOP	-	DEOXIDIZER	155	CHROMIC-SULFURIC ACID	50%	AMBIENT	6 MONTHS
BUILDING 30	WELDING SHOP	-	ALKALINE CLEANER	155	RIDOLINE 327	-	160°F	6 MONTHS
BUILDING 40	MACHINE SHOP	-	VAPOR DEGREASER	110	TRICHLORDETHYLENE	100%	190°F	6 MONTHS

PROCESS TANK LIST

LOCATION: HUGHES AIRCRAFT COMPANY, TUCSON, AZ. PROJECT: WATER POLLUTION CONTROL STUDY

COMP DIM CHK REN APP MHB

WILSON EQUIPMENT ENGINEERS & PLANNERS SALINA ATLANTA ALBUQUERQUE

FILE 71-190A

DATE FEB. 1972

SHEET 9 / 9

CHEMICAL PURCHASE LIST

Acids

		PURCHASED			
		1969	1970	1971	Oct., 1971
Acid, Chromic Flake	lbs	3,300	4,900	0	4,000
Acid, Fluoboric 48%	gals	90	120	145	140
Acid, Hydrochloric	lbs	1,080	2,034	2,688	2,760
Acid, Hydrofluoric 70% Technical Grade	lbs	10,120	13,160	6,000	7,200
Acid, Muriatic	lbs	21,980	19,740	11,060	2,940
Acid, Nitric, 42 Deg. Baume	lbs	41,140	45,700	32,130	6,800
Acid, Nitric, Reagent	lbs	210	847	476	98
Acid, Phosphoric, Reagent	lbs	8	32	0	0
Acid, Sulfuric, Reagent	lbs	3,204	7,344	0	1,170
Acid, Sulfuric, 66 Deg. Baume	lbs	13,000	16,200	27,000	6,400

CHEMICAL PURCHASE LIST

Chemicals

		PURCHASED			
		1969	1970	1971	Oct., 1972
Aluminum Oxide	lbs	70	80	0	0
Ammonia, Aqueous	gals	1,705	1,375	605	605
Ammonium Bifluoride	lbs	100	0	0	450
Ammonium Hydroxide	lbs	28	48	72	0
Ammonium Hydroxide, 26 Deg. Baume	gals	1,100	1,760	1,248	1,144
Ammonium Molyborate	lbs	0	0	0	10
Ammonium Persulfate	lbs	1,000	3,250	6,500	1,000
Hydrogen Peroxide 30%	gals	13	26	0	65
Iron Chloride	lbs	16,492	4,172	0	589
Lead Fluoborate 50% Concentrate	gals	10	30	25	0
Lime, Hydrated	lbs	32,800	64,600	105,750	80,500
Nickel Chloride	lbs	300	100	200	700
Nickel Sulfate Plating Salts	lbs	100	200	0	300
Potassium Hydroxide	lbs	0	0	400	0
Potassium Cyanide	lbs	0	100	0	200
Potassium Silver Cyanide	lbs	0	25	0	6
Potassium Sulfate	lbs	15	0	5	0
Soda Ash Tech. Grade	lbs	0	0	6,600	0
Sodium Chloride Butter Salt	lbs	100	500	0	0
Sodium Cyanide	lbs	400	1,000	1,000	400
Sodium Dichromate	lbs	1,600	2,300	400	1,100
Sodium Hydroxide	lbs	2,250	2,250	900	13,500
Sodium Hydroxide Reagent Grade	lbs	10	10	10	0
Stannous Fluoborate Concentrate 47%	gals	35	55	90	75
Zinc Oxide	lbs	100	100	0	0

CHEMICAL PURCHASE LIST

Solvents

		PURCHASED			
		1969	1970	1971	Oct., 1972
Acetone, Tech. Grade	lbs	990	660	385	330
Acetone, Reagent	gals	2	5	0	5
Chlorothene "NU"	gals	0	0	7,095	9,350
Hexane	gals	110	55	55	0
Methyl Ethyl Ketone	gals	800	150	150	30
Organ-TU	gals	55	0	55	110
Solvent, Alpha Reliasolv	gals	0	0	55	0
Solvent, Dry Cleaning	gals	3,630	3,190	2,805	385
Solvent, Geon 22	gals	0	50	50	0
Thinner PT-1002	gals	2,200	1,100	1,320	1,100
1,1,1, Trichlorethane	gals	6,105	9,350	14,200	20,000
Trichlorethylene, Stabalized	gals	16,855	26,730	20,680	18,590
Trichlotrifluoroethane	gals	600	700	500	600

Organics

Alcohol, Absolute Isopropyl	gals	540	486	0	432
Alcohol, Denatured	gals	54	378	54	54
Alcohol Ethyl, 200 proof	gals	6	6	5	7
Alcohol Ethyl, Denatured	gals	0	0	20	20
Monoethanolamine, M.E.A.	gals	30	60	0	0
Rochelle Salts, Sodium Potassium Tartrate	lbs	300	100	200	400
Silica Gel	lbs	20	5	160	60
Sodium Polyphosphate, Legin Sulphonate	lbs	0	100	0	200
Sodium Acetate	lbs	0	25	25	25

Oils, Greases & Coolants

Coolant, Electron Discharge M/C	gals	0	0	55	55
Fluid, Cutting, Mistic Metal Mover	gals	32	18	61	9
Fluid, Cutting, Tapmatic No. 1	gals	0	0	0	55
Fluid, Cutting, Tapmatic No. 2	gals	0	0	0	52
Fluid, Grinding, Norton No. 803	gals	30	20	0	10

CHEMICAL PURCHASE LIST

Oils, Greases & Coolants Contd.

		PURCHASED			
		1969	1970	1971	Oct., 1972
Fluid, Tapping, Molly Dee	gals	29	11	10	6
Grease, Ball Bearing	lbs	18	30	14	15
Grease Bearing No. 1	lbs	0	360	120	0
Grease, Bearing No. 2	lbs	120	360	0	120
Grease, Silicon, High Vacuum	lbs	22	14	7	1
Grease, Waterproof, White	lbs	10	5	25	10
Kerosene Pearl 42-44	gals	150	200	300	50
Lubricant, Inner Slide	lbs	36	48	36	36
Mold Release, Ram No. 225	gals	4	22	117	54
Oil, Chevron, Base C	gals	110	110	110	55
Oil, Coolant Gari-904	gals	275	4,125	6,105	6,050
Oil, Coolant, Water Soluble	gals	55	660	550	330
Oil, Crystal, Solid Lonconite MSP	lbs	0	0	0	8
Oil, Cutting, Mineral Lard Base	gals	550	440	0	0
Oil, Cutting, Non-corrosive	gals	330	715	0	275
Oil, Cutting, Sulfurized	gals	4,325	2,750	605	385
Oil, Gear, SAE 90	lbs	360	360	120	240
Oil, Heavy Duty Chlorinated Soluble	gals	220	935	220	0
Oil, High Speed Spinale, SSU 77	gals	55	55	220	0
Oil, Honing, Ferrous	gals	55	275	165	55
Oil, Insulating & Electrical	gals	0	0	55	0
Oil, Lubricating, Hydraulic	gals	0	0	210	50
Oil, Lubricating, Preservative	gals	165	110	55	0
Oil, Machine, SSU 603	gals	0	0	0	55
Oil, Machine Way, SSU 175	gals	220	220	385	0
Oil, Machine Way, SSU 317	gals	715	660	275	495
Oil, Peanut	gals	5	10	55	115
Oil, Pennzoil, SAE 10-20-30	gals	0	0	385	330
Oil, Quench	gals	0	0	305	495
Oil, Refrigeration	gals	6	0	24	0
Oil, Refrigeration, Sunisco 3G	gals	36	27	49	38
Oil, Richfield Eagle	gals	330	330	440	385
Oil, Sungrind HD 55X	gals	660	0	0	220
Oil, Sungrind HD 55XX	gals	605	2,585	2,475	1,925

CHEMICAL PURCHASE LIST

Oils, Greases & Coolants Contd.

		PURCHASED			
		1969	1970	1971	Oct., 1972
Oil, Turbine, SSU 156	gals	2,475	5,115	3,520	3,575
Oil, Turbine, SSU 223	gals	275	550	55	275
Oil, Turbine, SSU 423	gals	220	110	385	0
Oil, Turbine, SSU 553	gals	165	55	0	0
Oil, Water Soluble, Hocut 3210	gals	0	0	440	385
Oil, Water Soluble, No. WST 250	gals	495	1,375	385	605
Oil, Vacuum Pump, Kinney, Super-X	gals	116	47	46	58
Oil, Vacuum Pump, Stokes V-Lube	gals	15	5	15	0
Parting and Release Agent - Non Silicone	ea	12	18	49	26
Silicon, Anti-Foam	lbs	0	240	280	480
Vasoline, Industrial	lbs	7	9	22	25

Proprietaries

Amchem, Inc.					
Alodine No. 1200	lbs	60	300	60	240
Amchem Deoxidizer No. 7	lbs	0	300	300	0
Amchem Deoxidizer Replenisher No. 17	lbs	0	300	0	600
American Chemical & Refining Co.					
ACR P-200 Gold Salt Troy	ozs	20	36	10	0
ACR 24K Gold Salt Acid	ozs	0	23	0	0
Betz Laboratories					
Liqui-Treat	gals	0	0	0	1,430
Sulfite No. 3	gals	0	0	0	110
Diversey Corp.					
Diversey Everite	lbs	0	1,000	1,000	1,000
Diversey No. 299	lbs	0	1,000	100	400
Diversey DS-9-301	gals	0	52	0	0
Diversey DS-9-302	gals	0	53	0	0
Diversey DS-9-333	gals	0	53	0	0

CHEMICAL PURCHASE LIST

Proprietaries Contd.

		PURCHASED			
		1969	1970	1971	Oct., 1972
DuPont					
Freon, Solvent TE 35	gals	1,760	4,235	3,080	660
Freon, TE	gals	2,090	6,545	2,365	330
MacDermid					
Phosphotex Grain Refiner M-760	lbs	300	600	100	100
Phosphotex B	gals	135	195	0	255
Phosphotex A-8	gals	275	495	220	495
Phosphotex Seal M-672	gals	10	105	120	75
Metex					
Cleaner Metex TS-40A	lbs	0	0	0	900
Stripper Metex Nickel SCB-A	lbs	0	0	0	100
Stripper Metex Nickel SCB-B	lbs	0	0	0	50
Remover, Tin - Lead	gals	145	150	0	5
Solder Brite	gals	230	170	205	200
Etch, Metex No. PTH-G-2	lbs	0	0	600	5,400
Solder Aid, Metex No. 9226	gals	0	0	55	0
Chemical Cleaner PTH 9066	gals	0	0	50	107
Shippley Co., Inc.					
Neutra-Etch	gals	0	0	240	1,830
Cuposit Accelerator No. 19	gals	8	20	76	119
Cuposit Catylist 9F	gals	11	17	82	26
Cuposit Copper Mix 328A	gals	10	51	68	1
Cuposit Copper Mix 328B	gals	13	62	73	2
Cuposit Copper Mix 328C	gals	9	38	15	2
Cuposit Cleaner-Conditioner No. 1175	gals	0	0	7	41
Electrodeless Copper Plate Component CP-70A	gals	0	0	290	1,050
Electrodeless Copper Plate Component CP-70M	gals	0	0	250	720
Electrodeless Copper Plate Component CP-70R	gals	0	0	120	460
Electrodeless Copper Plate Component CP-70Z	gals	0	0	230	720
Electrodeless Nickel NL-62	gals	400	280	600	1,370
Nickel, Replenisher NL-62R	gals	100	100	150	100
Nickel, Replenisher NL-62S	gals	230	230	280	180

CHEMICAL PURCHASE LIST

Proprietaries Contd.

		PURCHASED			
		1969	1970	1971	Oct., 1972
Technic, Inc.					
Brightener, Orosene PC	qts	1	6	0	4
Gold Salts, Orosene PC Troy	ozs	15	65	68	30
Orosene Buffer Salts	lbs	0	25	0	75
Unichrome, Inc.					
Unichrome Compound 4-A	gals	3	15	15	15
Unichrome Compound PC-1	gals	50	100	15	0
Unichrome Compound PY-61-H	gals	66	0	38	75
Unichrome Liquid C-10XB	gals	0	624	104	624
Unichrome Liquid C-11XB	gals	0	208	208	520
Wyandotte Chem. Corp.					
Cleaner, Aldet	lbs	0	0	0	2,450
Wyandotte Altrex	lbs	4,125	5,250	2,625	0
Wyandotte No. 90	gals	385	605	440	440
Wilbro					
Salt Replenisher Wilbro No. 2-24	ozs	71	184	135	35
Gold Concentrate Wilbro Bright No. 1	ea	44	17	9	2

Miscellaneous

Activated Black Magic Oxide	lbs	0	0	0	1,600
Alcor Sealer No. 570	lbs	0	0	300	500
Bondaid Etchant or Tetraetch	gals	8	4	1	4
Chemical, Hydro Squeegee CIP-99U	gals	105	595	500	640
Chlorine, 70%, Perchloron or Pittchlor	lbs	800	600	400	300
Chrome-Sulfuric Etchant S. Cal. Chem. No. MRTL-20	gals	5,459	16,536	11,554	12,985
Cleaner, Machine No. MC 109	gals	0	495	165	440
Compound, Carburizing Quicklight No. NB 3-8	lbs	100	200	200	100
Compound, Corrosion Preventative	gals	50	0	0	15
Dye, Aluminum Deep Black MLW, Am Hoechist	gals	495	110	0	110

CHEMICAL PURCHASE LIST

Miscellaneous Contd.

		PURCHASED			
		1969	1970	1971	Oct., 1972
Dynacide Anti-Bacterial	gals	0	3	3	1
Eganol "C" Special Chemical Blacken	lbs	0	0	0	900
Etching Chemical Turco W.D. No. 1	gals	7	4	1	1
Fluid Dilectric Coolant	gals	0	0	430	215
Fluid, Fusing, Solder Reflow No. 202	gals	0	0	0	40
Fluid, Spirit Duplicating	gals	150	100	0	150
Peptone Solution, Stablized B & A 2007	gals	4	8	9	14
Powder, Bakelite, Black Transcopic No. 40155	lbs	15	25	20	30
Powder, Bakelite, Transopic No. 40157	lbs	0	5	0	20
Ridoline No. 322	lbs	0	225	450	450
Salt Dulite, Steel Kote	lbs	2,400	1,600	0	0
Scale Inhibitor Calgon No. 340	gals	0	66	90	110
Solvent, Pioneer No. 70-161-2	gals	0	95	335	165
Stripper, Penstrip 1547Y or Chemline Q-293	gals	110	1,100	1,100	1,265
Trycres YL Phosphate	lbs	6	0	6	6
Versene FE-3 Chelating Agent	lbs	0	800	200	0

APPENDIX I

FEDERAL FACILITIES INVENTORY REQUIREMENTS

INVENTORY REQUIREMENTS OF FEDERAL AGENCY HAZARDOUS WASTE FACILITIES

Section 3016(a) of Subtitle C of the Solid Waste Disposal Act or the Resource Conservation and Recovery Act (RCRA) of 1976 is amended by PL 98-616, dated 8 November 1984. Under this amendment, each Federal agency shall submit an inventory of each hazardous waste management site which the agency has owned or operated. Specifically, Section 3016(a) of the amendments sets forth the inventory requirements, as follows:

(1) A description of the location of each site at which any such [hazardous waste] treatment, storage, or disposal has taken place before the date on which permits are required under Section 3005 for such storage, treatment, or disposal, and where hazardous waste has been disposed, a description of hydrogeology of the site and the location of withdrawal wells and surface water within one mile of the site.

(2) Such information relating to the amount, nature, and toxicity of the hazardous waste in each site as may be necessary to determine the extent of any health hazard which may be associated with any site.

(3) Information on the known nature and extent of environmental contamination at each site, including a description of the monitoring data obtained.

(4) Information concerning the current status of the site, including information respecting whether or not hazardous waste is currently being treated, stored, or disposed of at such site (and if not, the date on which such activity ceased) and information respecting the nature of any other activity currently carried out at such site.

(5) A list of sites at which hazardous waste has been disposed and environmental monitoring data has not been obtained, and the reasons for the lack of monitoring data at each site.

(6) A description of response actions undertaken or contemplated at contaminated sites.

(7) An identification of the types of techniques of waste treatment, storage, or disposal which have been used at each site. . . ."

This IRP Phase I report contains the information required by this Subtitle C amendment with respect to former waste disposal sites located at U.S. Air Force Plant (AFP) 44, Tucson, Arizona. Table I cross-references these requirements with the information provided in the Phase I report, by each former disposal site. Other recent hydrogeologic investigations and site studies conducted at AFP 44 contain information with respect to AFP 44's former waste disposal practices, the extensive monitoring data collected at AFP 44, and the extent of contamination in the AFP 44 area. These reports are as follows:

- Field Investigations of Uncontrolled Hazardous Waste Sites, FIT Project, Preliminary Site Inspection Report, Hughes Aircraft Co., U.S. AFP 44, Tucson, Arizona. EPA Contract No. 68-01-6056. April 15, 1981. Prepared by Ecology and Environment, Inc.

- Phase I [Stage I] Investigation of Subsurface Conditions in the Vicinity of Abandoned Waste Disposal Sites, Hughes Aircraft Company Manufacturing Facility, Tucson, Arizona. Volumes I, II, & III. January 15, 1982. Prepared by Hargis & Montgomery [Associates], Inc.

- Phase II [Stage II] Investigation of Subsurface Conditions in the Vicinity of Abandoned Waste Disposal Sites, Hughes Aircraft Company Manufacturing Facility, Tucson, Arizona. Volumes I, II, & III. March 12, 1982. Prepared by Hargis & Montgomery [Associates], Inc.

- Summary of 1982 Hydrologic Monitoring Program, U.S. AFP 44, Tucson Arizona. July 15, 1983. Prepared by Hargis & Montgomery [Associates], Inc.

- Interim Report: Digital Simulation of Contaminant Transport in the Regional Aquifer System, U.S. AFP 44, Tucson, Arizona. October 11, 1982. Prepared by Hargis & Montgomery [Associates], Inc.

- Analysis of Data Collected by Tucson Groundwater Contamination Study Task Force in the Vicinity of Tucson International Airport, Tucson, Arizona. Volumes I & II. June 22, 1984. Prepared by Hargis & Montgomery [Associates], Inc.

- Summary of 1983 Hydrologic Monitoring Program, U.S. AFP 44, Tucson, Arizona. Volumes I & II. June 22, 1984. Prepared by Hargis & Montgomery [Associates], Inc.

TABLE I. LOCATION IN PHASE I REPORT OF FEDERAL AGENCY HAZARDOUS WASTE FACILITIES INVENTORY (FFI) REQUIREMENTS [Section 3016(a), PL 98-616, 8 November 1984], BY FORMER DISPOSAL SITE

FFI Requirement	Site 1 Disposal Trenches	Site 2 Disposal/ Burn Pit	Site 3 Waste Disposal Pits	Site 4 Wastewater Ponds	Site 5 Sludge Drying Beds	Site 6 Drainage Channels	Sites 7,8,10 Fire Training Areas
1. Location of Site, Requirement (1)	§ 4.6.3.1; and Figure 4-6	§ 4.6.3.2; and Figure 4-6	§ 4.6.3.3; and Figure 4-6	§ 4.6.3.4; and Figure 4-6	§ 4.6.3.4; and Figure 4-6	§ 4.6.3.5; and Figure 4-6	§ 4.4, 4.6.3.6, 4.6.3.7, 4.6.3.9; and Figure 4-4 and 4-6
2. Waste Management Method at Site, and Amount and Nature of Managed Waste, Requirements (2) and [7]	§ 4.1.1-4.1.3, 4.1.4.5, 4.6.3.1; and Table 4-8	§ 4.1.1-4.1.3, 4.1.4.5, 4.6.3.2; and Table 4-8	§ 4.1.1, 4.1.2, 4.1.4.5, 4.6.3.3; and Table 4-8	§ 4.1.3, 4.1.4.2, 4.1.4.4, 4.6.1.1, 4.6.1.2, 4.6.3.4; and Table 4-8	§ 4.6.1.2, 4.6.3.4; and Table 4-8	§ 4.1.3, 4.1.4.1 - 4.1.4.4, 4.6.1.1, 4.6.1.2, 4.6.3.5; and Table 4-8	§ 4.4, 4.6.3.6, 4.6.3.7, 4.6.3.9; and Table 4-6
3. Description of Hydrogeology, Requirement (1)	§ 3.4, 3.5, 3.7.1, 3.7.2, 3.8.1, 5.0; and Figure 3-4 - 3-8	Same report locations as Site 1	Same report locations as Site 1	Same report locations as Site 1	Same report locations as Site 1	Same report locations as Site 1	Same report locations as Site 1
4. Locations of Withdrawal Wells and Surface Waters, Requirement (1)	§ 3.3, 3.6; and Figures 3-2 and 5-1	Same report locations as Site 1	Same report locations as Site 1	Same report locations as Site 1	Same report locations as Site 1	Same report locations as Site 1	Same report locations as Site 1

TABLE I. LOCATION IN PHASE I REPORT OF FEDERAL AGENCY HAZARDOUS WASTE FACILITIES INVENTORY (FFI) REQUIREMENTS [Section 3016(a), PL 98-616, 8 November 1984], BY FORMER DISPOSAL SITE (continued)

FFI Requirement	Site 1 Disposal Trenches	Site 2 Disposal/ Burn Pit	Site 3 Waste Disposal Pits	Site 4 Wastewater Ponds	Site 5 Sludge Drying Beds	Site 6 Drainage Channels	Sites 7,8,10 Fire Training Areas
5. Monitoring Data and Extent of Contamination, Requirements (3) and (5)	§ 3.8.2, 3.8.2.1 - 3.8.2.6, 5.6; and Figures 3-10 - 3-14	§ 3.8.2, 3.8.2.1 - 3.8.2.6, 5.3; and Figures 3-10 - 3-14	§ 3.8.2, 3.8.2.1 - 3.8.2.6, 5.1; and Figures 3-10 - 3-14	§ 3.8.2, 3.8.2.1 - 3.8.2.6, 5.2; and Figures 3-10 - 3-14	§ 3.8.2, 3.8.2.1 - 3.8.2.6, 5.4; and Figures 3-10 - 3-14	§ 3.8.2, 3.8.2.1 - 3.8.2.6, 5.5; and Figures 3-10 - 3-14	§ 3.8.2, 3.8.2.1 - 3.8.2.6, 5.7, 5.9, 5.11; and Figures 3-10 - 3-14
6. Status of Site, Requirement (4)	§ 4.6.3.1 and 5.6	§ 4.6.3.2 and 5.3	§ 4.6.3.3 and 5.1	§ 4.6.3.4 and 5.2	§ 4.6.3.4 and 5.4	§ 4.6.3.5 and 5.5	§ 4.4, 4.6.3.6, 4.6.3.7, 4.6.3.9, 5.7, 5.9, and 5.11
7. Response Actions at Site, Taken or Contemplated, Requirement (6)	§ 3.8.2.7, 4.6.3.1, and 5.6	§ 3.8.2.7, 4.6.3.2, and 5.3	§ 3.8.2.7, 4.6.3.3, and 5.1	§ 3.8.2.7, 4.6.3.4, and 5.2	§ 3.8.2.7, 4.6.3.4, and 5.4	§ 3.8.2.7, 4.6.3.5, and 5.5	§ 3.8.2.7, 4.6.3.6, 4.6.3.7, 4.6.3.9, 5.7, 5.9, and 5.11

END

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